NOAA/EPA FINDING THAT OREGON HAS NOT SUBMITTED A FULLY APPROVABLE COASTAL NONPOINT PROGRAM

FOREWORD

This document contains the bases for the finding by the National Oceanic and Atmospheric Administration (NOAA) and the United States (U.S.) Environmental Protection Agency (EPA) (collectively, the federal agencies) that the State of Oregon (State) has not submitted a fully approvable Coastal Nonpoint Pollution Control Program (Coastal Nonpoint Program) as required by section 6217(a) of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA), 16 U.S.C. 1455b. NOAA and EPA arrive at this decision because they find that the State has not adopted additional management measures applicable to forestry that are necessary to achieve and maintain applicable water quality standards under Clean Water Act section 303 and to protect designated uses. NOAA and EPA first identified and notified the State of the need to implement the additional measures in 1998.

On January 13, 1998, the federal agencies approved the Oregon Coastal Nonpoint Program subject to specific conditions (see *Oregon Conditional Approval Findings*). Since then, NOAA and EPA have been working with the State to address the conditions. The State has made incremental modifications to its program and has since met most of those conditions.

On December 20, 2013, the federal agencies provided notice of their intent to find that the State has not fully satisfied the conditions related to new development, onsite sewage disposal systems (OSDS), and additional management measures for forestry (see *Oregon Coastal Nonpoint Program NOAA/EPA Proposed Finding*). The federal agencies invited public comment on the proposed findings, as well as on the extent to which those findings support a finding that the State has not submitted an approvable program under CZARA. Based on comments and concerns the federal agencies received about agriculture nonpoint source management in the State, the federal agencies also invited public comment on the adequacy of the State's programs and policies for meeting the CZARA 6217(g) agriculture management measures and conditions placed on Oregon's Coastal Nonpoint Program. Because the December 20, 2013, notice of intent did not propose a specific decision on whether Oregon had satisfied the CZARA 6217(g) agriculture management measures and the public did not have an opportunity to comment on a specific proposed decision and rationale for that decision, the adequacy of Oregon's agriculture programs is not a basis for the findings that Oregon has not submitted an approvable coastal nonpoint program. (For a summary of the comments received and the federal agencies' response to them, see *NOAA and EPA Response to Comments Regarding the Agencies' Proposed Disapproval Finding that Oregon has Not Submitted a Fully Approvable Coastal Nonpoint Program*.)

In response to NOAA and EPA's proposed findings, Oregon provided an additional submission in support of its coastal nonpoint program on March 20, 2014 (see *Oregon's Response to Proposed Disapproval Findings*).[1]

NOAA and EPA have carefully reviewed the public comments received and the State's March 2014 submission and have made a finding that Oregon has not submitted a fully approvable coastal nonpoint program. This decision is made because the State did not address the additional management measures for forestry condition. Based on information the State provided in March, the federal agencies believe that Oregon has now satisfied the conditions for new development and OSDS, so those conditions are no longer a basis for the finding that Oregon has not submitted an a fully approvable coastal nonpoint program.

For further understanding of terms in this document and the basis of this decision, the reader is referred to the following documents:

- *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* (EPA January 1993);
- *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance* (NOAA and EPA January 1993);
- *Flexibility for State Coastal Nonpoint Programs* (NOAA and EPA March 1995);
- *Final Administrative Changes to the Coastal Nonpoint Pollution Control Program Guidance for Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990* (CZARA) (NOAA and EPA October 1998);
- *Policy Clarification on Overlap of 6217 Coastal Nonpoint Programs with Phase I and II Stormwater Regulations* (NOAA and EPA December 2002); and
- *Enforceable Policies and Mechanisms for State Coastal Nonpoint Source Programs* (NOAA and EPA January 2001).

Electronic copies of the documents cited above as well as any other references cited in this document and the Federal Register notice announcing this action will be available at the following website: http://coast.noaa.gov/czm/pollutioncontrol.

SCOPE OF DECISION

This document explains NOAA and EPA's finding regarding the additional management measures for forestry condition. This finding forms the basis for the federal agencies' decision that the State has not submitted a fully approvable program.[2] The document also notes that the new development and OSDS management measures are no longer a basis for this decision. In addition, the document acknowledges the comments received regarding the adequacy of Oregon's agriculture programs and policies for meeting the 6217(g) agriculture management

[1] In a Settlement Agreement entered in 2010 to resolve a lawsuit brought by a nonprofit organization, Northwest Environmental Advocates v. Locke, et al., Case No. CV09-0017-PK (D. Ore), NOAA and EPA agreed to make a final decision on whether to approve or disapprove Oregon's Coastal Nonpoint Program by May 15, 2014, later extended to January 30, 2015.

[2] CZARA provides for NOAA and EPA to withhold a portion of CZMA Section 306 and CWA Section 319 grant funds when a disapproval decision is made. NOAA and EPA may withhold funding as early as July 1, 2015.

measures and conditions placed on Oregon's Coastal Nonpoint Program. However, at this time, the agencies have not made a decision on the adequacy of the agricultural measures.

NOAA and EPA's findings in this document are based on information the State has submitted in support of each condition, the federal agencies' knowledge of coastal nonpoint source pollution management in Oregon, and the public comments received. Oregon may–and is encouraged to–continue to work on and improve its program to satisfy all coastal nonpoint program requirements. Should the State submit subsequent information upon which NOAA and EPA determine that the State has submitted a fully approvable program, the federal agencies will provide another opportunity for public comment. At that time, the public will be asked to provide comment on whether the State has satisfied all conditions placed on its program in 1998 and met all CZARA requirements.

FINDING OF NOT HAVING SUBMITTED A FULLY APPROVABLE PROGRAM

NOAA and EPA have determined that the State of Oregon has not submitted a fully approvable program pursuant to Section 6217(a) of CZARA.

I. UNMET CONDITION

A. ADDITIONAL MANAGEMENT MEASURES– FORESTRY

PURPOSE OF MANAGEMENT MEASURE: The purpose of this management measure is to identify additional management measures necessary to achieve and maintain applicable water quality standards and protect designated uses for land uses where the 6217(g) management measures are already being implemented under existing nonpoint source programs but water quality is still impaired due to identified nonpoint sources.

CONDITION FROM JANUARY 1998 FINDINGS: Within two years, Oregon will identify and begin applying additional management measures where water quality impairments and degradation of beneficial uses attributable to forestry exist despite implementation of the 6217(g) measures (1998 Findings, section X).

FINDING: Oregon has not satisfied this condition. By not adopting and implementing additional management measures applicable to forestry and forested lands that are necessary to achieve and maintain water quality standards and to protect designated uses, Oregon has not submitted a fully approvable program under CZARA.

RATIONALE: Oregon proposed to address the additional management measures for forestry condition through a combination of regulatory and voluntary programs. Those measures include best management practices or other control measures by rule established by the Board of Forestry (Board). In addition, the Environmental Quality Commission (EQC), the rulemaking body for the Oregon Department of Environmental Quality (ODEQ), can petition the Board if it

believes the Forest Practices Act (FPA) rules are not adequate for achieving water quality standards. While Oregon has made some progress towards meeting this condition, the State has not identified or applied additional management measures that fully address the program weaknesses the federal agencies noted in the January 13, 1998, Findings for Oregon's Coastal Nonpoint Program. Specifically, the State has not implemented or revised management measures, backed by enforceable authorities, to (1) protect riparian areas for medium-sized and small fish-bearing (type "F") streams and non-fish-bearing (type "N") streams; (2) address the impacts of forest roads, particularly on so-called "legacy" roads; (3) protect high-risk landslide areas; and (4) ensure adequate stream buffers for the application of herbicides, particularly on non-fish-bearing streams.

Protection of Riparian Areas: Oregon relies on both regulatory and voluntary measures to provide riparian protections for medium-sized and small fish-bearing streams (type "F" streams) and non-fish-bearing streams (type "N" streams). Generally, under the State's current FPA rules, no tree harvesting is allowed on private lands within 20 feet of fish-bearing streams, or medium-sized and large non-fish-bearing streams. Also, all snags and downed wood that do not represent a safety or fire hazard must be retained within riparian management areas around small and medium-sized fish-bearing streams (from the stream edge out to 50 and 70 feet, respectively). In addition, the FPA rules establish conifer basal area and density targets for some riparian management areas. For example, along medium-sized fish-bearing streams, there is a requirement to leave 30 trees (at least 8 inches diameter at breast height [DBH]) per 1,000 feet. Oregon has no vegetation retention requirements for small non-fish-bearing streams in the Coast Range and Western Cascades.

In addition to regulatory requirements, the forestry industry in the State of Oregon has adopted voluntary measures to protect riparian areas for high aquatic potential streams (i.e., streams with low gradients and wide valleys where large woody debris recruitment is most likely to be effective at enhancing salmon habitat). These voluntary measures include large wood placement, retaining additional basal area within stream buffers, large tree retention, and treating large and medium-sized non-fish-bearing streams the same as fish-bearing streams for buffer retentions.[3]

Based on the results of a number of studies including those summarized below, NOAA and EPA previously determined and continue to find that additional management measures (beyond those in FPA rules and the voluntary program) for forestry riparian protection around medium-sized and small fish-bearing streams and non-fish-bearing streams are necessary to attain and maintain water quality standards and to protect designated uses. Therefore, Oregon must still adopt and implement management measures applicable to the forestry land use and forested areas in order to protect small and medium-sized fish-bearing streams and non-fish-bearing streams from water quality impairments attributable to forestry practices in riparian areas.

A significant body of science, including 1) the Oregon Department of Forestry (ODF) Riparian and Stream Temperature Effectiveness Monitoring Project (RipStream)[4]; 2) *A Statewide*

[3] According to Oregon's March 2014 coastal nonpoint program submittal, information on voluntary efforts was reported to the Oregon Watershed Restoration Inventory. http://coastalmanagement.noaa.gov/nonpoint/oregonDocket/StateofOregonCZARAsubmittal3-20-14.pdf.

[4] Three peer-reviewed articles present the results of the RipStream analysis:

Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality (i.e., the *Sufficiency Analysis*)[5]; and 3) the Governor's Independent Multidisciplinary Science Team (IMST) Report on the adequacy of the Oregon forest practices in recovering salmon and trout[6], indicates that riparian protection around small and medium-sized fish-bearing streams and non-fish-bearing streams in Oregon is not sufficient to achieve and maintain water quality and protect designated uses. The 2011 RipStream reports found that FPA riparian protections on private forest lands did not ensure achievement of the Protection of Cold Water (PCW) criterion under the Oregon water quality standard for temperature.[7,8] The PCW criterion prohibits human activities (e.g., timber harvest) from increasing stream temperatures by more than 0.3ºC at locations critical to salmon, steelhead, or bull trout. The RipStream analysis demonstrated that the chance of a site managed using FPA rules exceeding the PCW criterion between a pre-harvest year and a postharvest year was 40 percent.[9,10]

The RipStream study also demonstrated that stream temperature fluctuations increased, in part, with a reduction in shade, and that shade was best predicted by riparian basal area and tree height. The findings suggest that riparian protection measures that maintain higher shade (such as measures implemented on State forest land) are more likely to maintain stream temperatures similar to control conditions.[11]

The 2002 Sufficiency Analysis found that the Oregon FPA's prescribed riparian buffer widths for small and medium-sized fish-bearing streams may be inadequate to prevent temperature impacts. That analysis concluded that 1) FPA standards for some medium-sized and small Type F streams in western Oregon may result in short-term temperature increases at the site level; and 2) FPA standards for some small Type N streams may result in short-term temperature increases at the site level that may be transferred downstream (this may impact water temperature and cold-water refugia) to fish-bearing streams.[12] In water bodies colder than the numeric criteria, temperature increases of 0.3°C measured for all sources combined at the point of maximum impact where salmon, steelhead, or bull trout are present is a violation of the State's PCW criterion.

As early as 1999, the IMST study found that the FPA rule requirements related to riparian buffers and large woody debris needed to be improved. Based on its scientific analysis, the IMST

Dent, L., D. Vick, K. Abraham, S. Shoenholtz, and S. Johnson. 2008. Summer temperature patterns in headwater streams of the Oregon Coast Range. *Journal of the American Water Resources Association* 44:803–813.

Groom, J.D., L. Dent, and L.J. Madsen. 2011a. Stream temperature change detection for state and private forests in the Oregon Coast Range. *Water Resources Research* 47 W01501. doi:10.1029/2009WR009061.

Groom, J.D., L. Dent, and L.J. Madsen. 2011b. Response of western Oregon stream temperatures to contemporary forest management. *Forest Ecology and Management*. doi:10.1016/j.foreco.2011.07.012.

[5] Oregon Department of Forestry and Oregon Department of Environmental Quality. 2002. *Sufficiency Analysis: A Statewide Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality*. Oregon Department of Forestry and Oregon Department of Environmental Quality.

[6] Independent Multidisciplinary Science Team. 1999. *Recovery of Wild Salmonids in Western Oregon Forests: Oregon Forest Practices Act Rules and the Measures in the Oregon Plan for Salmon and Watersheds*. Technical Report 1999-1 to the Oregon Plan for Salmon and Watersheds, Governor's Natural Resources Office, Salem, OR.

[7] Groom et al., 2011a.

[8] Daugherty, P., and J.D. Groom. 2011. *Update on Private Forests Riparian Function and Stream Temperature (RipStream) Project*. Staff Report; November 3, 2011.

[9] Ibid. 2.

[10] Groom et al., 2011a.

[11] Ibid.2. 3.

[12] Oregon Department of Forestry and Oregon Department of Environmental Quality, 2002, pp. 44-45.

team concluded, "…the current site-specific approach of regulation and voluntary action is not sufficient to accomplish the recovery of wild salmonids."[13] The IMST team made the following recommendations: 1) Because nongame fish and other aquatic organisms play a role in a functioning stream system, and the distribution of salmonids will change over time, non-fish-bearing streams should be treated no differently than fish-bearing streams when determining the buffer width protections;[14] 2) there should be an increase in the basal area and requirements for riparian management areas for both small and medium-sized streams, regardless of the presence of fish; and 3) there should be an increase in the number of trees within the riparian management area for both fish- and non-fish-bearing small and medium-sized streams.[15]

In 2013, the EPA, together with the U.S. Geological Survey (USGS) and the Bureau of Land Management, reevaluated and summarized pertinent scientific theory and empirical studies to address the effects of riparian management strategies on stream function, with a focus on temperature.[16] With regard to no-cut buffers adjacent to clearcut harvest units, the paper noted that substantial adverse effects from reduced available shade have been observed with no-cut buffers ranging from 20 to 30 meters,[17] and that minimal adverse effects on stream shading and temperature have been observed in studies that examined no-cut buffer widths of 46 meters.[18] For no-cut buffer widths of 46–69 meters, the effects of tree removal on shade and temperature were either not detected or were minimal.[19] The paper also documented that, with no-cut buffer widths of less than 20 meters, pronounced reductions in shade and increases in temperature occurred, as compared to wider buffers. The most dramatic effects were observed at the narrowest buffer widths (less than or equal to 10 meters).[20] As already noted, existing FPA standards for small and medium-sized fish-bearing streams require only 20-foot (or approximately 7-meter) no-cut buffers within a riparian management zone of approximately 17–23 meters. No vegetation retention is required on small non-fish-bearing streams in the Coast Range and Western Cascades.

Oregon also has been investing in three paired watershed studies that are designed to analyze the effects of timber harvesting on a watershed and reach scale.[21] Several commenters have cited the paired watershed study as evidence that the current FPA practices for riparian protection are effective at achieving and maintaining water quality standards and protecting designated uses. Unpublished preliminary data from the Hinkle Creek study indicate that changes in stream temperature after timber harvest along non-fish-bearing streams were variable. In addition, there was no measureable downstream effect on temperatures.[22] The variation in stream temperature and overall net observed temperature decrease, however, could be attributable to increased slash debris along the stream after harvest, as well as a likely increase in stream flow post-harvest that

[13] Independent Multidisciplinary Science Team. 1999. 2.
[14] Ibid. 21 and 43.
[15] Ibid. 44-45.
[16] Leinenbach, P., G. McFadden, and C. Torgersen. 2013. *Effects of Riparian Management Strategies on Stream Temperature*. Prepared for the Interagency Coordinating Subgroup (ICS), 22 pp.
[17] Brosofske et al., 1997; Kiffney et al., 2003; Groom et al., 2011b as cited in Leinenbach et al. 2013.
[18] Science Team Review, 2008; Groom et al., 2011a as cited in Leinenbach et al. 2013.
[19] Anderson et al., 2007; Science Team Review, 2008; Groom et al., 2011a; Groom et al., 2011b as cited in Leinenbach et al. 2013.
[20] Jackson et al., 2001; Curry et al., 2002; Kiffney et al., 2003; Gomi et al., 2006; Anderson et al., 2007 as cited in Leinenbach et al. 2013.
[21] Watershed Research Cooperative. Accessed 2014. Watershed Studies. Available online at: http://watershedsresearch.org/watershed-studies/.
[22] Watersheds Research Cooperative. 2008. *Hinkle Creek Paired Watershed Study*. Available online at: http://oregonforests.org/sites/default/files/publications/pdf/WRC_Hinkle.pdf.

could reduce any increase in temperatures and contribute to lower mean stream temperatures.[23] Because a variety of factors confound the draft conclusions from the Hinkle Creek study, NOAA and EPA do not rely on that analysis. In its evaluation of the study results, DEQ concluded that temperature data from the Hinkle Creek and Alsea River studies show that for fish-bearing streams, temperature increases downstream from the harvest sites were very similar to the increases found in the RipStream study.[24] The 2011 RipStream reports found that FPA riparian protections on private forest lands did not ensure achievement of the PCW criterion under the Oregon water quality standard for temperature.[25,26]

NOAA and EPA acknowledge that Oregon is working to address some of the inadequate riparian protection measures in the FPA. The Board has the authority to regulate forest practices through administrative rule making and require changes to the FPA rules to protect small and medium-sized fish-bearing streams. Recognizing the need to better protect small and medium Type F streams, the Board directed ODF to undertake a rule analysis process that could lead to revised riparian protection rules. At its September 2014 meeting, the Board voted unanimously in favor of continuing to analyze what changes might be needed in the Oregon Forest Practice Rules to provide greater buffer protection for medium-sized and small fish-bearing streams on private forest lands. NOAA and EPA encourage the State to move forward with this rule-making process expeditiously.

The Board and ODF have not proposed increased protection for riparian areas around small non-fish-bearing streams. As previously discussed in the IMST study, non-fish-bearing streams should be treated no differently than fish-bearing streams when determining the appropriate buffer width required to protect designated uses.[27] Oregon should revise and implement additional management measures for riparian areas adjacent to small non-fish-bearing streams necessary to achieve and maintain water quality standards and protect designated uses. These measures may be regulatory or voluntary, however voluntary measures must be monitored for effectiveness and backed up by enforcement authorities should voluntary measures not be implemented or effective.

Impact of Forestry Roads: In the 1998 approval conditions, NOAA and EPA identified specific concerns with Oregon's FPA rules concerning road density and maintenance, particularly with respect to so-called "legacy" roads. The federal agencies noted that "legacy" roads—roads constructed and used prior to adoption of the FPA in 1971 and not used or maintained since—were not required to be treated and stabilized before closure. In some locations, that practice has resulted in significantly altered surface drainage, diversion of water from natural channels, and serious erosion or landslides, conditions that threaten to impair coastal waters and protect designated uses.

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[23] Kibler, K.M. 2007. *The Influence of Contemporary Forest Harvesting on Summer Stream Temperatures in Headwater Streams of Hinkle Creek, Oregon*. Master's thesis, Oregon State University.
[24] Seeds, J., R. Mitchie, D. Jepsen, and G. Foster. 2014. *Responses to Questions/Concerns Raised by Oregon Forestry Industries Council Regarding the Protecting Cold Water Criterion of Oregon's Temperature Water Quality Standard*. Oregon Department of Environmental Quality and Oregon Department of Fish and Wildlife Memo. June 19, 2004.
[25] Groom et al., 2011a.
[26] Daugherty and Groom, 2011.
[27] Independent Multidisciplinary Science Team, 1999.

Legacy roads threaten water quality standards and designated uses due to their location and construction. Historic settlement patterns and relative ease-of-construction led early developers to preferentially locate roads in valley bottoms near streams. Those roads often paralleled low gradient streams (historically the most productive coho habitat) and crossed many tributaries.[28] Prior to modern best management practices, mid-slope roads would often be connected to the valley bottom roads to access harvest units.[29] The poorly designed forest roads increase sediment supplied to streams by altering hillslope hydrology, surface runoff, and sediment flux.[30] They represent a chronic source of low-level sediment over time.[35] The ecological consequences of sediment continuously supplied from roads may be equally or even more detrimental over time than periodic sediment pulses.[36] Furthermore, legacy roads sometimes serve as initiation points for landslides many years, or even decades, after construction.[37] For example, one study found that forestry roads in Oregon built before 1984 have higher landslide rates than those built later.[38]

Oregon's IMST found that:

> "'Old roads and railroad grades' on forestlands, sometimes called legacy roads, are not covered by the OFPA rules unless they are reactivated for a current forestry operation or purposes. IMST believes the lack of a mechanism to address the risks presented by such roads is a serious impediment to achieving the goals of the Oregon Plan. A process that will result in the stabilization of such roads is needed, with highest priority attention to roads in core areas, but with attention to such roads and railroad grades at all locations on forestlands over time."[39]

In 1996, the National Marine Fisheries Service (NMFS) provided a scientific analysis of the draft Coastal Salmon Restoration Initiative (CSRI) report—which later evolved into the Oregon Plan for Salmon and Watersheds. NMFS indicated that the forest practice rules have no well-defined process to identify problems with older logging roads and railroad grades constructed prior to 1994.[40]

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[28] Nicholas J., B. McIntosh, and E. Bowles. 2005. *Oregon Coastal Coho Assessment. Part 1: Synthesis of the Coastal Coho ESU Assessment.* Oregon Watershed Enhancement Board and Oregon Department of Fish and Wildlife, Salem, OR. 69 pp.

[29] Wemple, B.C., F.J. Swanson, and J.A. Jones. 2001. Forest roads and geomorphic process interactions, Cascade range, Oregon. *Earth Surface Processes and Landforms* 26:191-204.

[30] Reid, L., M. and T. Dunne. 1984. Sediment production from forest road surfaces. *Water Resources Research* 20(11):1753-1761; Luce, C.H., and T.A. Black. 1999. Sediment production from forest roads in western Oregon. *Water Resources Research* 35(8):2561-2570; Wemple, B.C., and J.A. Jones. 2003. Runoff production on forest roads in a steep, mountain catchment. *Water Resources Research* 39, doi:10.1029/2002WR001744; Skaugset, A., and M.M. Allen. 1998. *Forestry Road Sedimentation Drainage Monitoring Project for Private and State Lands in Western Oregon.* Prepared for the Oregon Department of Forestry by the Forestry Engineering Department, Oregon State University; Robison, E.G., K. Mills, J. Paul, L. Dent, and A Skaugset. 1999. *Storm Impacts and Landslides of 1996: Final Report.* Forest Practices Technical Report, Vol. 4. Oregon Department of Forestry, Corvallis.

[35] MacDonald, L.H. and D.B.R. Coe. 2008. Road sediment production and delivery: processes and management. *Proceedings of the First World Landslide Forum, International Programme on Landslides and International Strategy for Disaster Reduction.* United Nations University, Tokyo, Japan. pp. 381–384.

[36] Detenbeck, N.E., P.W. Devore, G.J. Niemi, and A. Lima. 1992. Recovery of temperate stream fish communities from disturbance: a review of case studies and synthesis of theory. *Environ. Manage.* 16:33-53.

[37] Oregon Department of Forestry and Oregon Department of Environmental Quality, 2002.

[38] Ibid. p. 33, Sessions, 1987.

[39] Independent Multidisciplinary Science Team, 1999, pp. 47.

[40] NOAA National Marine Fisheries Service. 1996. *Analysis of the Oregon Department of Forestry's (ODF) Most Recent Submission for the State of Oregon's Coastal Salmon Restoration Initiative.* September 10, 1996 memo from Rowan Baker to Steve Morris and Elizabeth Garr.

In addition to water quality impacts, sedimentation and erosion from forestry roads have adverse impacts on salmon. Salmonid spawning is one of Oregon's designated uses. Logging roads are a source of fine sediments that enter spawning gravel and can lower the success of spawning and recruitment for coho salmon.[41] NMFS's scientific analysis for their Endangered Species Act (ESA) section 7 listing for Oregon coast coho salmon also continues to recognize forestry roads, including legacy roads, as a source of sediment and a threat to Oregon coastal coho salmon. NMFS explained that "existing and legacy [forestry] roads can contribute to continued stream degradation over time through restriction of debris flows, sedimentation, restriction of fish passage, and loss of riparian function."[42]

Since 1998, the Board has made several improvements to general road maintenance measures to improve water quality. Changes made in 2002 and 2003 included (1) establishment of a *Avoiding Roads in Critical Locations* Policy to avoid building roads in critical locations (e.g., high-hazards landslide areas, steep slopes, or within 50 feet of water bodies); (2) creation of additional rules to address wet-weather hauling (OAR 629-625-0700); and (3) revision of an existing road drainage rule to reduce sediment delivery (OAR 629-625-0330). Those improvements should reduce sedimentation on roadways in forested areas in order to achieve water quality standards and to protect designated uses. The new drainage requirements, however, become operative only when new road construction or reconstruction of existing roads occurs. The rule changes and new policies do not address legacy roads (i.e., roads that do not meet current State requirements with respect to siting, construction, maintenance, and road drainage) or impairments associated with a large portion of the existing road network where construction or reconstruction is not proposed.

Oregon proposed to address those legacy road issues and gaps in its FPA rules through voluntary efforts, including restoration and monitoring activities carried out through the voluntary Oregon Plan. For example, in its March 2014 submittal in response to NOAA and EPA's proposed determination, the State described ODF's voluntary Road Hazard and Identification and Risk Reduction Project through which private and State forestland owners survey their road networks to identify roads that pose risks to salmonid habitat and prioritize roads for remediation. While Oregon reports that thousands of road miles have been inspected and repaired across the State since the inception of the program in 1997, Oregon does not have a monitoring or tracking program that can report on the significance of these efforts relative to the universe of the road network, nor report on whether these projects addressed active forest roads and roads retired according to current FPA practices, and which projects addressed problems associated with older, legacy roads. As noted in the Oregon Coastal Coho Assessment,[43] old roads make up the majority of forest roads and the road inventory data on private land is often not made available. As a result, it is not possible to determine the extent to which voluntary efforts have addressed the sedimentation problems and landslide risk posed by the legacy road network.

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[41] Cederholm, C.J., L.M. Reid, and E.O. Salo. 1980. *Cumulative Effects of Logging Road Sediment on Salmonid Populations in the Clearwater River, Jefferson County, Washington*. Contribution No. 543. College of Fisheries, University of Washington, Seattle, WA.
[42] NOAA National Marine Fisheries Service. 2012. *Scientific Conclusions of the Status Review for Oregon Coast Coho Salmon (Oncorhynchus kisutch)*. NOAA Technical Memorandum NMFS-NWFSC-118, June 2012. Pg. 78.
[43] Nicholas et al., 2005.

The federal agencies are also concerned about the long-term implementation of the voluntary program. As noted in the State's March 2014 submission, "voluntary reporting of OPSW [Oregon Plan for Salmon and Watersheds] voluntary measures has diminished in the past years, however it is reasonable to assume that voluntary measure implementation has not." The State does not provide the basis for this statement. Without methods for tracking and evaluating the effectiveness of those voluntary programs, the federal agencies cannot approve the voluntary approach for addressing the forestry management measures as they pertain to old or legacy roads.

Oregon also noted that it has entered into a cooperative agreement with the U.S. Forest Service to update the State's geographic information system (GIS) data layer for forest roads. The data layer will help the State conduct a rapid road survey to evaluate and prioritize road risks to soil and water resources. Oregon noted it hoped to begin the survey in 2014. NOAA and EPA encourage the State to move forward with the road survey. However, the federal agencies are not aware if the GIS data layer and the survey will include (or even identify) legacy roads or whether the State will use the data to direct future management actions.

In addition, the State also discussed it was undertaking a third-party audit in 2014 to assess compliance with the FPA rules governing forest road construction and maintenance among other issues. While NOAA and EPA encourage the State to continue to conduct that and other audits to assess compliance with FPA rules, as noted earlier, legacy roads are not subject to FPA rules. Since the audit will assess compliance with the FPA rules, NOAA and EPA conclude that issues resulting from legacy roads as well as issues resulting from general road maintenance where construction or reconstruction is not occurring will not be addressed in this audit since the FPA rules do not apply in these situations.

In summary, NOAA and EPA recognize that legacy roads are being addressed through voluntary measures and that they have been the target of significant landowner investment. As noted in the Oregon Coastal Coho Assessment,[44] however, old roads make up the majority of forest roads, and road inventory data on private land is not widely available. As a result, NOAA and EPA cannot determine, and the State has not made information-based representations specifying, the extent to which voluntary efforts have addressed the sedimentation problems and landslide risk posed by the legacy road network.

In addition, as the federal agencies' *1998 Final Administration Changes Memo* states, in order for states to rely on voluntary programs to meet coastal nonpoint program requirements, a state must, among other things (1) describe the voluntary program, including the methods for tracking and evaluating those programs the State will use to encourage implementation of the management measures; and (2) provide a legal opinion from its Attorney General asserting the State has adequate backup enforcement authority for the voluntary measures and commit to exercising the backup authority when necessary. While the State has provided the federal agencies with a legal opinion detailing the suitability of its backup authorities, it has not demonstrated (either in writing or through past practice) a commitment to exercise its backup

[44] Ibid.

authority to require implementation of the additional management measures for forestry roads, as needed, nor identified a prior instance when it may have exercised that authority.

Additionally, the State has not described specifically how voluntary efforts have and will continue to address legacy road issues within the coastal nonpoint management area or how it will continue to monitor and track the implementation of those measures to address forestry road issues, including legacy roads.

The suite of voluntary programs Oregon has described could satisfy the forestry roads element of this management measure. However, as discussed above, additional information is needed at this time. The federal agencies encourage the State to provide a commitment to use its backup authority to ensure implementation of forestry road additional management measures. The agencies also encourage the State to move forward with establishing a road survey or inventory program that considers both active, inactive, and legacy roads, including a mechanism for tracking and monitoring implementation of voluntary measures to carry out identified priority forest road improvements. To support an approvable coastal nonpoint program, the inventory could establish, among other things, a timeline for addressing priority road issues, including retiring or restoring forest roads that impair water quality, and a reporting and tracking component to assess progress for remediating identified forest road problems. Establishing a roads inventory with appropriate reporting metrics would provide valuable information on State and private landowner accomplishments to improve and repair roads and identify where further efforts are needed. Such an approach could help verify whether the combination of current rules and the Oregon Plan's voluntary measures are effective in managing forest roads to protect streams within a reasonable timeframe.

Protection of Landslide-Prone Areas: In the 1998 findings, the federal agencies identified areas where existing practices under the FPA and FPA rules should be strengthened to achieve and maintain water quality standards and protect designated uses; among them was the need to provide better protection of areas at high risk for landslides.

Oregon proposed to address the landslide element of the additional management measures for forestry condition through a mix of regulatory and voluntary approaches. Since January 13, 1998, Oregon has amended the Oregon FPA rules to require the identification of landslide hazard areas in timber harvesting plans and road construction and placed certain restrictions on harvest and road activities within the designated high-risk areas for public safety (OAR 629-623-0000 through 629-623-0800). Under these amendments, however, shallow, rapidly moving landslide hazards directly related to forest practices are addressed only as they relate to risks for loss of life and property, not for potential adverse impacts on water quality or designated uses. Timber harvest and the construction of forest roads, when alternatives are not available, continue without controls on high-risk landslide hazard areas as long as such harvest and road construction are not deemed a public safety risk.

In addition to the regulatory programs, Oregon stated that it employs a voluntary measure under the Oregon Plan that gives landowners credit for leaving standing live trees along landslide-prone areas as a source of large wood. The large wood, which may eventually be deposited into

fish-bearing stream channels, contributes to stream complexity, a key limiting factor for coastal coho salmon recovery. While this is a good management practice, the measure is not designed to protect high-risk erosion areas but rather to ensure large wood is available to provide additional stream complexity when a landslide occurs. NOAA and EPA do not consider this voluntary action a sufficient management measure to reduce high-risk landslides that adversely affect water quality standards or designated uses.

Also, Oregon's voluntary program is incomplete. To rely on voluntary approaches to meet CZARA requirements, a state not only needs to describe the voluntary approach but also needs to describe how it will monitor and track implementation of that approach, provide a legal opinion asserting the state has adequate backup authority to ensure implementation of the management measure, and provide a commitment to use that backup authority, when needed.

As noted in the January 13, 1998, findings, logging on unstable steep terrain can increase landslide rates, which contributes to water quality impairments. A number of studies continue to show significant increases in landslide rates after clearcuts compared to unmanaged forests in the Pacific Northwest. For example, one study found that in three out of four areas studied in very steep terrain, landslide densities and erosion volumes were greater in stands that were clearcut during the previous nine years.[45] The study observed that landslide rates on Mettman Ridge, within the Oregon Coast Range, increased three to nine times the background rate after clearcut harvest. Another study performed a regional analysis from the Mettman Ridge study and found that forest clearing dramatically accelerates shallow landslides in steep terrain typical of the Pacific Northwest.[46] In another study in southwestern Washington, landslide densities in recently harvested sites were roughly two to three times the landslide densities in old stands when exposed to rainfall intensities greater than the 100-year event.[47] That research found that very few landslides occurred when rainfall was less than or equal to a 100-year rainfall event.

Other research has examined the role of root cohesion on landslide susceptibility in forested landscapes. "Root cohesion" is a measure of the lateral reinforcing strength the root system provides. The higher the root cohesion, the better the root system can stabilize the soil, reducing the risk of landslides.[48] One study noted that median lateral root cohesion is less for industrial forests with significant understory and deciduous vegetation (6.8–23.2 kiloPascal (kPa), a unit of pressure) compared to natural forests dominated by conifers (25.6–94.3 kPa). Additionally, in clearcut areas, the researchers found that lateral root cohesion is uniformly less than or equal to 10 kPa, making those areas much more susceptible to landslides.

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[45] Robison et al., 1999.

[46] Montgomery, D. R., K. M. Schmidt, H. M. Greenberg, and W. E. Dietrich. 2000. Forest clearing and regional landsliding. *Geology* 28: 311-314.

[47] Turner, T.R., S.D. Duke, B.R. Fransen, M.L. Reiter, A.J. Kroll, J.W. Ward, J.L. Bach, T.E. Justice, and R.E. Bilby. 2010. Landslide densities associated with rainfall, stand age, and topography on forested landscapes, southwestern Washington, USA. *Forest Ecology and Management* 259:2233–2247.

[48] Schmidt, K.M., J.J. Roering, J.D. Stock, W.E. Dietrich, D.R. Montgomery, and T. Schaub. 2001. The variability of root cohesion as an influence on shallow landslide susceptibility in the Oregon Coast Range. *Canada Geotech. J* 38; 997-1024.

Sakals and Sidle modeled the effect of different harvest methodologies on root cohesion over time.[49] They found that, of the methodologies examined (i.e., clearcutting, single-tree selection cutting, and strip cutting), clearcuts produced the greatest decline in root cohesion. Further, they found that root cohesion may continue to decline for 30 years postharvest. That decline is attributed to the decay of the root systems of the harvested trees and the fact that young root systems have smaller root volumes and less radial rooting extent. They concluded that clearcuts on hazardous slopes could increase the number of landslides as well as the probability of larger landslides. They also stated that a management approach requiring the retention of conifers on high-risk slopes would increase root cohesion and reduce the risk of landslides.

The peer-reviewed science demonstrates that timber harvesting in landslide-prone areas degrades water quality and impairs designated uses in Pacific Northwest streams by delivering excessive sediment load that can block fish passage and smother or scour spawning grounds. Whittaker and McShane explained:

> "In the Pacific Northwest, … [l]andslides alter aquatic habitats by elevating sediment delivery, creating log jams, and causing debris flows that scour streams and stream valleys down to bedrock (Rood 1984; Cederholm and Reid 1987; Hogan et. al. 1998). The short-term and long-term impacts of higher rates of landslides on fish include habitat loss, reduced access to spawning and rearing sites, loss of food resources, and direct mortality (Cederholm and Lestelle 1974; Cederholm and Salo 1979; Reeves et. al. 1995). The restoration of geomorphic processes to natural disturbance regimes is crucial to the recovery of endangered salmonids (*Oncorhynchus* spp.) and other aquatic species in the Pacific Northwest as these species evolved under conditions with much lower sediment delivery and landslide frequency (Reeves et. al. 1995; Montgomery 2004)."[50]

In 2013, the Cooperative Monitoring Evaluation and Research committee (CMER) of the Washington State Department of Natural Resources published a study that explored landslide response to a large 2007 storm in southwestern Washington.[51] Within the 91-square-mile study area, a total of 1,147 landslides were found within harvest units that delivered sediment load to public resources (mostly streams). The majority (82 percent) occurred on hillslopes and the rest initiated from roads. In examining the landslides, the study found that unstable hillslopes logged with no buffer had a significantly higher (65 percent) landslide density than did mature stands. Unstable slopes logged with no buffer also delivered 347 percent more sediment than slopes with unlogged mature stands. The authors conclude that buffers on unstable slopes likely reduce landslide density and sediment volume. That conclusion has important implications for water quality and designated beneficial uses. Sediments delivered from landslides clog and damage fish gills, suffocate fish eggs, smother aquatic insect larvae, and fill in spaces in streambed gravel where fish lay eggs. Sediment can also carry other pollutants into water bodies, creating issues

[49] Sakals, M.E., and R.C. Sidle. 2004. A spatial and temporal model of root cohesion in forest soils. *Canadian Journal of Forest Research* 34(4): 950-958.

[50] Whittaker, K.A., and D. McShane. 2012. Comparison of slope instability screening tools following a large storm event and application to forest management policy. *Geomorphology* 145-146:115-122.

[51] Stewart, G., J. Dieu, J. Phillips, M. O'Connor, and C. Veldhuisen. 2013. *The Mass Wasting Effectiveness Monitoring Project: An examination of the landslide response to the December 2007 storm in Southwestern Washington.* Cooperative Monitoring, Evaluation and Research Report CMER 08- 802; Washington Department of Natural Resources, Olympia, WA.

for domestic water supply and public water providers.[52]

Given the evidence that clear-cutting increases the rate of landslides and that landslides adversely affect water quality and designated beneficial uses, adoption and implementation of additional management measures applicable to forestry in landslide-prone areas is necessary to achieve and maintain water quality standards and protect designated uses. To develop the required additional management measures, the State could pursue several actions that would collectively address this issue, such as some of the following:

- Adopt harvest and road construction restrictions that apply to all high-risk landslide-prone areas with moderate-to-high potential to impact water quality and designated uses.

- Develop a scientifically rigorous process for identifying high-risk areas and unstable slopes based on field review by trained staff. The process could include the use of slope instability screening tools to identify high-risk landslide areas that take into account site-specific factors such as slope, geology and geography, and planned land management activities (e.g., roads development).

- Develop more robust voluntary programs to encourage and incentivize the use of forestry best management practices to protect high-risk landslide areas that have the potential to impact water quality and designated uses, such as employing no-harvest restrictions around high-risk areas and ensuring that roads are designed, constructed, and maintained in a manner that minimizes the risk of triggering slope failures. Widely available maps of high-risk landslide areas could improve water quality by informing foresters during harvest planning.

- Institute a monitoring program to track compliance with the FPA rules and voluntary guidance for high-risk landslide-prone areas and the effectiveness of the practices in reducing slope failures.

- Establish an ongoing monitoring program that assesses the underlying causes and water quality impacts of landslides shortly after they occur and generates specific recommendations for future management. Integrate into the Total Maximum Daily Load (TMDL) development process procedures to identify high-risk landslide-prone areas and specific best management practices to protect those areas. For example, in the Mid-Coast Basin, ODEQ is currently developing a sediment TMDL to address water quality limited waters for bio-criteria, turbidity, and sediment. To support the development of the TMDL, the Oregon Department of Geology and Mineral Resources completed landslide inventory maps for two watersheds in the Mid-Coast Basin, finding hundreds of

[52] Whittaker and McShane, 2012; Cederholm et al., 1980; Jensen, D.W., E.A. Steel, A.H. Fullerton, and G.R. Pess. 2009. Impact of fine sediment on egg-to-fry survival of pacific salmon: A meta-analysis of published studies. *Reviews in Fisheries Science* 17(3):348-359; EPA. 2003. *Developing Water Quality Criteria for Suspended and Bedded Sediments (SABS): Potential Approaches (Draft)*. U.S. Environmental Protection Agency; Bauer, S.B., and S.C. Ralph. 1999. *Aquatic Habitat Indicators and their Application to Water Quality Objectives within the Clean Water Act, Section 3*. U.S. Environmental Protection Agency, Region 10. EPA 910-R-99-014; Oregon Department of Environmental Quality. No Date. *Water Quality Standards: Turbidity*. Available at: http://www.deq.state.or.us/wq/standards/turbidity.htm.

previously unidentified landslides.[58] As part of the TMDL, ODEQ will complete a source assessment of the landslides in relationship to the water quality impairments. NOAA and EPA encourage the State to complete the TMDL and include specific practices that landowners are required to follow in order to reduce pollutants causing impairments addressed in the TMDL.

If Oregon plans to rely on voluntary efforts, the State will need to (1) describe the full suite of voluntary practices it plans to use to address this management measure; (2) describe how it will ensure the use of these voluntary practices and track their implementation; and (3) provide a legal opinion that the State has backup authority to ensure implementation of the management measure and a commitment to use the backup authority, when needed.

Ensure Adequate Stream Buffers for Application of Herbicides, Particularly on Non-fish-bearing (Type N) Streams: In the January 1998 findings, the federal agencies noted that Oregon had adopted forest practices rules that require aerial spray buffers for most pesticide applications (OAR 629-620-0400(7)(b)). The rule changes, however, did not include spray buffers for the aerial application of herbicides along non-fish-bearing streams commonly found in headwaters. NOAA and EPA determined that additional management measures to protect non-fish-bearing streams during the aerial application of herbicides on forestlands were necessary to achieve and maintain water quality standards and to protect designated uses.

Since 1998, Oregon has provided to the federal agencies several documents describing the programs it uses to manage pesticides, most recently in March 2014. In addition to the FPA rule buffers noted above, the State also addresses pesticide issues through the Chemical and Other Petroleum Product Rules (OAR 629-620-0000 through 800) Pesticide Control Law (ORS 634); and best management practices set by the Oregon Department of Agriculture (ODA) and federal pesticide label requirements under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); as well as the State's Water Quality Pesticide Management Plan[59] and Pesticide Stewardship Partnership (PSP) program.[60] In its March 2014 submittal, Oregon noted that it specifically relies on best management practices set by ODA and EPA under FIFRA for the protection of small non-fish-bearing streams.

The aerial application of herbicides such as glyphosate, 2,4-D, atrazine, and others is a common practice in the forestry industry in Oregon.[61,62] Herbicides are sprayed to control weeds on recently harvested parcels to prevent competition with newly planted tree saplings. In 2008, more than 800,000 pounds of pesticides, the majority of which were herbicides (at least 700,000

[58] Burns, W. J., S. Duplantis, C. Jones, and J. English. 2012. *LIDAR Data and Landslide Inventory Maps of the North Fork Siuslaw River and Big Elk Creek Watersheds, Lane, Lincoln and Benton Counties, Oregon.* Open-File Report O-12-07, Oregon Department of Geology and Mineral Industries.
[59] State of Oregon (ODA, ODEQ, ODF, and OHA). 2011. *Pesticide Management Plan for Water Quality Protection.*
[60] ODEQ. 2012. *Fact Sheet: Pesticide Stewardship Partnerships in Oregon.* DEQ 12-WQ-021. Updated March 2012.
[61] Wagner, R. G., M. Newton, E. C. Cole, J. H. Miller, and B. D. Shiver. 2009. The role of herbicides for enhancing forest productivity and conserving land for biodiversity in North America. *Wildlife Society Bulletin* 32(4):1028-1041.
[62] Norris, L.A., H.W. Lorz, and S.V. Gregory. 1991. Forest chemicals. Influences of forest and rangeland management on salmonid fishes and their habitats. *American Fisheries Society Special Publication* 19:207-296.

pounds) were used for forestry purposes in Oregon.[63] Research has shown that herbicides may adversely impact water quality and designated uses to protect aquatic life.[64] Herbicides applied through the air commonly reach nearby streams through aerial drift[68] and runoff from the land.[71,72]

Oregon does not require spray buffers for aerial application of herbicides on small non-fish-bearing streams. Applicators can spray directly up to and over non-fish-bearing streams. In addition, there are no requirements for riparian harvest buffers along small non-fish-bearing streams. For example, in the Triangle Lake area in the Oregon coastal nonpoint management area, there are areas where aerial application of herbicides occurred in areas where timber was harvested to the stream edge.[73] Riparian harvest buffers could serve as defacto spray buffers since they would prevent timber harvesting up to the stream and, therefore, would not require herbicide spraying over the nonharvested area to control weeds. Riparian buffers can also help filter any herbicide pollutants from runoff before it reaches the streams.[74,75]

Given that non-fish-bearing streams comprise about 70 percent of the total stream length and feed fish-bearing streams, the wide use of herbicides by the forestry industry in coastal Oregon and the lack of any spray or riparian buffers that would help protect non-fish-bearing streams from adverse impacts due to the aerial application of herbicides threaten designated uses in Oregon coastal waters. Small, headwater non-fish-bearing streams play an important role in delivering cold, clean water to downstream fish-bearing streams.[76] Therefore, it is reasonably foreseeable that Oregon coastal waters are threatened by herbicide pollutants and that additional management measures that will provide greater protection of non-fish-bearing streams during the aerial application of herbicides are warranted to achieve water quality standards and protect designated uses (CZARA sec. 6127(b)(1)(B), 16 U.S.C. 1455b).

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[63] Oregon Department of Agriculture. 2009. *Pesticide Use Reporting System. 2008 Annual Report.* Available online at: http://www.oregon.gov/ODA/shared/Documents/Publications/PesticidesPARC/PesticideusereportingsystemAnnualreport2008.pdf

[64] Relyea, R.A. 2005. The impact of insecticides and herbicides on the biodiversity and productivity of aquatic communities. *Ecological Applications* 15:618–627; Relyea, R., and J. Hoverman. 2006. Assessing the ecology in ecotoxicology: a review and synthesis in freshwater systems. *Ecology Letters* 9:1157–1171; Battaglin, W.A., K.C. Rice, M.J. Focazio, S. Salmons, and R.X. Barry. 2009. The occurrence of glyphosate, atrazine, and other pesticides in vernal pools and adjacent streams in Washington, DC, Maryland, Iowa, and Wyoming, 2005-2006. *Environmental Monitoring and Assessment* 155(1-4): 281-307; Graymore, M., F. Stagnitti, and G. Allinson. 2001. Impacts of atrazine in aquatic ecosystems. *Environment International* 26(7-8):483-495.

[68] Majewski, M.S., and P.D. Capel. 1996. *Pesticides in the Atmosphere: Distribution, Trends, and Governing Factors*. U.S. Geological Survey. Open File Report 94-506. National Water-Quality Assessment Program; Van Den Berg, F., R. Kubiak, W.G. Benjey, M.S. Majewski, S.R. Yates, G.L. Reeves, J.H. Smelt, and A.M.A. Van Der Linden. 1999. Emiss*ions of Pesticides into the Air. Fate of Pesticides in the Atmosphere: Implications for Environmental Risk Assessment*. pp. 195-218; Pimentel, D., and L. Levitan. 1986. Pesticides: amounts applied and amounts reaching pests. *Bioscience* 36(2).

[71] Gilliom, R.J., J.E. Barbash, C.G. Crawford, P.A. Hamilton, J.D. Martin, N. Nakagaki, L.H. Nowell, J.C. Scott, P.E. Stackelberg, G.P. Thelin, and D.M. Wolock. 2006. *The Quality in Our Nation's Water: Pesticides in the Nation's Streams and Groundwater, 1992-2001*. Circular 1291.

[72] Larson, S.J., P.D. Capel, and M. Majewski. 1995. Pesticides in Surface Waters: Distribution, Trends and Governing Factors. *Volume 2 of Pesticides in the Hydrologic System Series*. Ann Arbor Press, Inc., Chelsea, MI.

[73] Leinenbach, P. 2015. *Images of forest harvest areas where herbicides were applied using aerial broadcast application methods with helicopters in the Triangle Lake region of the central coast range of Oregon.* Memorandum from P. Leinenbach to A. Henning. January 12, 2015.

[74] Welsch, D.J. 1991. *Riparian Forest Buffers: Function and Design for Protection and Enhancement of Water Resources*. USDA Forest Service. NA-PR-07-91.

[75] Kiffney. P.M., J.S. Richardson, and J.P. Bull. 2003. Responses of periphyton and insects to experimental manipulation of riparian buffer width along forest streams. *Journal of Applied Ecology* 40:1060-1076.

[76] Gomi, T., R.C. Sidle, and J.S. Richardson. 2002. Understanding processes and downstream linkages of headwater systems. *Bioscience* 52(10).

Other recent studies and reports also support NOAA and EPA's determination that additional management measures for forestry are needed to address aerial herbicide application due to a reasonably foreseeable threat to coastal waters and designated uses. One of the common indirect adverse effects on water quality and designated uses, particularly cold-water fisheries uses, occurs because herbicides can reduce the growth and biomass of primary producers (i.e., algae and phytoplankton) that form the base of the aquatic food chain. A decrease in primary production (e.g., plants and algae) can have significant effects on consumers, such as salmonids and other animals that depend on the primary producers for food.[77] The effects are often reported at herbicide concentrations well below levels that would have a direct effect on consumers. In addition, there are concerns about the increased toxicity of mixtures of herbicides and other pesticides to aquatic organisms.[78] EPA's biological evaluation of the effects of 2,4-D[1], a commonly used herbicide, concluded that aerial forestry use is likely to adversely affect the California red-legged frog based on harmful impacts to freshwater fish, which are used as a surrogate for aquatic-phase amphibians. EPA's acute levels of concerns for 2,4-D on freshwater fish were exceeded for the aerial forestry use pattern, based on aquatic exposure modeling assuming the labeled rate of one application at 4 lb acid equivalent (a.e.)/acre and available toxicity data.[81]

A few studies have indicated that aerial application might not result in herbicides exceeding toxic thresholds for humans or aquatic life in fish-bearing and drinking water streams,[82] at the interface of fish- and non-fish-bearing streams,[83] or at drinking water facilities in Oregon.[84] None of the studies, however, were focused on impacts to non-fish-bearing streams and do not provide sufficient evidence, based on other information, that coastal waters and designated uses are not reasonably or foreseeably threatened by the aerial application of herbicides over non-fish-bearing streams. For example, an ODF study that looked at the effectiveness of FPA aerial spray buffers for herbicides and fungicides on fish-bearing streams stated that they could not draw any conclusions about the FPA's effectiveness at protecting water quality for non-fish-bearing streams.[85] A USGS study in the McKenzie River basin looked broadly at urban, forestry, and agriculture pesticide use and the impacts it had on drinking water.[86] The study, which took place outside the coastal nonpoint management area, also notes that forestry sampling was inconsistent because of irregular and intermittent pesticide application patterns among tributaries and the difficulty of capturing runoff events in the spring after application. A National Council for Air and Stream Improvement (NCASI) study in the Needle Branch in the Oregon Coast Range

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[77] Marczak, L.B., T. Sakamaki, S. L. Turvey, I. Deguise, S. L. R. Wood, and J. S. Richardson. 2010. Are forested buffers an effective conservation strategy for riparian fauna? An assessment using meta-analysis. *Ecological Applications* 20:126–134.

[78] Relyea, R.A. 2009. A Cocktail of Contaminants: How mixtures of pesticides at low concentrations affect aquatic communities. *Oecologia* 159(2):363-376; Gilliom et al., 2006; Carpenter, K.D., S. Sobeszczyk, A. Arnsberg, and F.A. Rinella. 2008. *Pesticide Occurrence and Distribution in the Lower Clackamas River Basin, Oregon, 2000-2005*. Scientific Investigations Report 2008-5027.

[81] Office of Pesticides Programs. 2009. *Risks of 2,4-D Use to the Federally Threatened California Red-Legged Frog (Rana Aurora draytonii) and Alameda Whipsnake (Masticophis lateralis euryxanthus)*. Pesticides Effects Determination. Environmental Date and Effects Division, Office of Pesticides Programs.

[82] Dent, L., and J. Robben. 2000. *Oregon Department of Forestry: Aerial Pesticide Application Monitoring Final Report*. Oregon Department of Forestry, Pesticides Monitoring Program. Technical Report 7.

[83] National Council for Air and Stream Improvement. 2013. *Measurement of Glyphosate, Imazapyr, Sulfometuron methyl, and Metsulfuron methyl in Needle Branch Streamwater*. Special Report No. 130-1.

[84] Kelly, V.J., C.W. Anderson, and K. Morgenstern. 2012. *USGS and Eugene Water and Electric Board. Reconnaissance of Land-Use Sources of Pesticides in Drinking Water, McKenzie River Basin, Oregon*. Scientific Investigations Report 2012-5091.

[85] Dent and Robben, 2000.

[86] Kelly et al., 2012.

looked at how herbicide levels in streams varied during storm events at three sample sites in harvest units downstream of non-fish-bearing areas where herbicides were applied aerially with no buffers.[87] The sample sites themselves were collected in fish-bearing streams with 50-foot riparian buffers. The study noted clear pulses of herbicides at each storm event with declining levels downstream and over several storms.

Oregon relies on the national best management practices established through the federal FIFRA pesticide labels to protect non-fish-bearing streams. Currently, EPA, NMFS, U.S. Fish and Wildlife Service, and U.S. Department of Agriculture are working to improve the national risk assessment process to include all ESA-listed species when registering all pesticides, including herbicides. Given the scale of this undertaking, the federal agencies are employing a phased, iterative approach during ongoing registration reviews. These ongoing federal processes, however, should not preclude Oregon from pursuing state-level improvements to manage herbicides in the context of its unique forestry landscape and sensitive species.

Oregon and other Pacific Northwest states have determined the importance of state action beyond the national FIFRA label requirements to protect water quality and designated uses, including salmon, in their respective states.[88] Oregon has 60-foot spray buffers for nonbiological insecticides and fungicides on non-fish-bearing streams (OAR 629-620-400(7)) and 60-foot spray buffers for herbicides on wetlands, and fish-bearing and drinking water streams (OAR 629-620-400(4)). Other Pacific Northwest states have established more stringent forestry spray buffer requirements for herbicides along non-fish-bearing streams. For example, for smaller non-fish-bearing streams, Washington maintains a 50-foot riparian and spray buffer (WAC-222-38-040). Idaho has riparian and spray buffers for non-fish-bearing streams of 100 feet (IAR 20-02-01). California sets riparian buffers for non-fish-bearing streams after consulting with the local forester, which implicitly restricts the aerial application of herbicides near the stream (14 CCR 4).

Though Oregon has neither spray nor riparian harvest buffers for herbicides that are aerially applied on small non-fish-bearing streams, the ODA Pesticide Division requires applicators to attend training and obtain licenses prior to spraying pesticides. ODF requires pesticide applicators to complete a Notification of Operation at least 15 days before applying on forestlands[89] and to maintain a daily chemical application form.[90] On the Notification of Operation form, the applicators must list which pesticides *might* be applied, the stream segments on which the pesticides *might* be applied, and when application *might* occur within a 2–3 month period. The notification form does not, however, specify when application will occur within a 1–2 week period or postapplication, the pesticides that were applied and how much. The form reminds the applicator of the required spray buffers for fish-bearing and drinking water streams, but does not specify protections for non-fish-bearing streams or voluntary best practices included

[87] National Council for Air and Stream Improvement, 2013.
[88] Peterson, E. 2011. *Comparative Characterization of Pacific Northwest Forestry Requirements for Aerial Application of Pesticides.* Memorandum to Scott Downey, EPA and David Powers, EPA. August 30, 2011.
[89] Oregon Department of Forestry. 2015. Forest Activity Electronic Reporting and Notification System (FERNS). Available at: https://ferns.odf.state.or.us/E-Notification
[90] Oregon Department of Forestry. 2013. Daily Chemical Application Record Form. Revised September 2013. Available at: http://www.oregon.gov/odf/privateforests/docs/ChemicalApplicationForm_Final.pdf.

in the OAR Guidance Manual for Chemicals and Other Petroleum Products (Division 620) that should be followed other than a general sentence that applicators should comply with rules under the Forest Practices Rule and label instructions.

Oregon's broader strategy for cross-program coordination on pesticides includes its Water Quality Pesticide Management Plan, Pesticide Stewardship Program, and Pesticide Analytical and Response Center (PARC). The Water Quality Pesticide Management Plan guides statewide actions to protect waters from pesticide contamination using water quality to drive adaptive management. Oregon's PSP is an ODEQ initiative that works with State and local partners to collect and analyze water samples in areas with the greatest potential for impacts to aquatic life and human health. PARC is a multistate agency group that coordinates investigations to collect and analyze information about reported incidents.

NOAA and EPA acknowledge the progress Oregon has made in establishing a multiagency management team and programs to assess and manage pesticide water quality issues. As these efforts apply to the aerial application of herbicides in the coastal nonpoint management area, however, the federal agencies note that water quality monitoring data on pesticides is still limited in the State and that, while Oregon has established ten PSP monitoring areas in nine watersheds, the State only launched two pilots within the coastal nonpoint management area very recently. While NOAA and EPA recognize that the PSP program targets the most problematic or potentially problematic watersheds and that Oregon received recent funding to expand into two new watersheds, the agencies believe that if monitoring data are to drive adaptive management, the State should develop and maintain more robust and targeted studies of the effectiveness of its pesticide monitoring and best management practices within the coastal nonpoint management area. The federal agencies encourage the State to design its monitoring program in consultation with EPA and NMFS.

NOAA and EPA believe that Oregon could develop additional management measures for forestry that will protect non-fish-bearing streams during the aerial application of herbicides to achieve and maintain water quality standards and protect designated uses through a variety of mechanisms. Some potential approaches could include one or more of the following actions:

- Adopt rules that would require spray buffers for the aerial application of herbicides along non-fish-bearing streams. Oregon may wish to look at spray buffer requirements that neighboring states have established for ideas;
- Adopt riparian buffer protections for timber harvest along non-fish-bearing streams that, by default, would also provide a buffer during aerial spraying;
- Expand existing guidelines for voluntary buffers for the aerial application of herbicides on non-fish-bearing streams;
- Educate and train aerial applicators of herbicides on the new guidance;
- Revise the ODF Notification of Operation form required prior to chemical applications on forestlands to include a check box for aerial applicators to indicate that they must adhere to FIFRA labels for all stream types, including non-fish-bearing streams;

- Track and evaluate the implementation of voluntary measures for the aerial application of herbicides along non-fish-bearing streams to assess the effectiveness of these practices and, if adjustments are needed, to achieve water quality standards and protect designated uses;
- Provide detailed maps of non-fish-bearing streams and other sensitive sites and structures to increase awareness of the areas that need protection among the aerial applicator community; and
- Encourage the use of global positioning system (GPS) technology, linked to maps of non-fish-bearing streams, to automatically shut off nozzles before crossing non-fish-bearing streams.

If Oregon chooses a voluntary approach, the State must also meet the other CZARA requirements for using voluntary, incentive-based programs as part of the State's coastal nonpoint program. This includes a description of the methods the State will use to track and evaluate the voluntary programs, a legal opinion stating it has the necessary backup authority to require implementation of the voluntary measures, a description of the process that links the implementing agency with the enforcement agency, and a commitment to use the existing enforcement authorities, where necessary.

II. CONDITIONS THAT ARE NO LONGER A BASIS FOR THIS DECISION

A. URBAN AREAS MANAGEMENT MEASURES—NEW DEVELOPMENT

PURPOSE OF MANAGEMENT MEASURE: The purpose of this management measure is 4-fold: (1) decrease the erosive potential of increased volumes and velocities of stormwater associated with development-induced changes in hydrology; (2) remove suspended solids and associated pollutants entrained in runoff that result from activities occurring during and after development; (3) retain hydrological conditions that closely resemble those of the predisturbance condition; and (4) preserve natural systems, including in-stream habitat.

CONDITION FROM JANUARY 1998 FINDINGS: Within 2 years, Oregon will include in its program: (1) management measures in conformity with the 6217(g) guidance; and (2) enforceable policies and mechanisms to ensure implementation throughout the coastal nonpoint management area (1998 Findings, section IV.A).

FINDING: Based on information provided in Oregon's March 2014 submission, NOAA and EPA now believe the State has satisfied this condition. The new development management measure is no longer a basis for finding that Oregon has failed to submit an approvable program under CZARA.

RATIONALE NOT INCLUDED: NOAA and EPA will provide a rationale for public comment if/when the federal agencies are in a position to propose full approval of Oregon's coastal nonpoint pollution control program at a later point in time.

B. OPERATING ONSITE SEWAGE DISPOSAL SYSTEMS

PURPOSE OF MANAGEMENT MEASURE: The purpose of this management measure is to minimize pollutant loadings from operating OSDS.

CONDITION FROM JANUARY 1998 FINDINGS: Within 2 years, Oregon will finalize its proposal to inspect operating OSDS, as proposed on page 143 of its program submittal (1998 Findings, section IV.C).

FINDING: Based on information provided in Oregon's March 2014 submission, NOAA and EPA now believe the State has satisfied this condition. The OSDS management measure is no longer a basis for finding that Oregon has failed to submit an approvable program under CZARA.

RATIONALE NOT INCLUDED: NOAA and EPA will provide a rationale for public comment if/when the federal agencies are in a position to propose full approval of Oregon's coastal nonpoint pollution control program at a later point in time.

III. ADDITIONAL COMMENTS

A. AGRICULTURAL MANAGEMENT MEASURES—EROSION AND SEDIMENT CONTROL, NUTRIENT, PESTICIDE, GRAZING, AND IRRIGATION WATER MANAGEMENT

As noted in the Foreword, the federal agencies invited public comment on the adequacy of the State's programs and policies for meeting the 6217(g) agriculture management measures and conditions placed on Oregon's Coastal Nonpoint Program.

PURPOSE OF MANAGEMENT MEASURES: The purposes of these management measures are to (1) reduce the mass load of sediment reaching a water body and improve water quality and the use of the water resource; (2) minimize edge-of-field delivery of nutrients and minimize leaching of nutrients from the root zone; (3) reduce contamination of surface water and ground water from pesticides; (4) reduce the physical disturbance to sensitive areas and reduce the discharge of sediment, animal waste, nutrients, and chemicals to surface waters; and (5) reduce nonpoint source pollution of surface waters caused by irrigation.

CONDITIONS FROM JANUARY 1998 FINDINGS: Within 1 year, Oregon will (1) designate agricultural water quality management areas (AWQMAs) that encompass agricultural lands within the coastal nonpoint management area, and (2) complete the wording of the alternative management measure for grazing, consistent with the 6217(g) guidance. Agricultural water quality management area plans will include management measures in conformity with the 6217(g) guidance, including written plans and equipment calibration as required practices for the nutrient management measure, and a process for identifying practices that will be used to achieve the pesticide management measure. The State will develop a process to incorporate the irrigation water management measure into the overall AWQMA plans.

Within 5 years, AWQMAPs will be in place (1998 Findings, section II.B).

DISCUSSION: In 2004, the federal agencies provided Oregon with an informal interim approval of its agriculture conditions, believing that the State had satisfied those conditions, largely though its Agriculture Water Quality Management Act (ORS 568.900-933, also known as SB 1010) and nutrient management plans (ORS-468B, OAR-603-074). At that time, the federal agencies found that those programs demonstrated that the State had processes in place to implement the 6217(g) management measures for agriculture as CZARA requires.

Although the federal agencies initially found that those programs enabled the State to satisfy the agriculture condition, prior to announcing the proposed decision, some specific concerns with the State's agriculture program were brought to the federal agencies' attention, such as:

- Enforcement is limited and largely complaint-driven; it is unclear what enforcement actions have been taken in the coastal nonpoint management area and what improvements resulted from those actions.
- The AWQMA plan rules are general and do not include specific requirements for implementing the plan recommendations (e.g., specific buffer requirements to adequately protect water quality and fish habitat).
- AWQMA planning has focused primarily on impaired areas when the focus should be on both protection and restoration.
- The State does not administer a formalized process to track implementation and effectiveness of AWQMA plans.
- AWQMA planning and enforcement does not address "legacy" issues created by agriculture activities that are no longer occurring.

Given these concerns, NOAA and EPA chose to solicit additional public comment on whether the State had satisfied the 6217(g) agriculture management measure requirements and the conditions related to agriculture placed on its program. The federal agencies appreciate the comments provided and are considering them closely. NOAA and EPA will work with the State, as necessary, to ensure it has programs and policies in place to satisfy all CZARA 6217(g) requirements for agriculture before proposing and making a final decision that the State has a fully approved coastal nonpoint program. For a summary of the comments received related to agriculture, see http://coast.noaa.gov/czm/pollutioncontrol/.

IV. LIST OF ACRONYMS AND ABBREVIATIONS

Acronym or Abbreviation	Definition
AWQMA	Agricultural water quality management area
AWQMAP	Agricultural water quality management area plan
BiOp	Biological opinion
Board	Board of Forestry

Acronym or Abbreviation	Definition
CMER	Cooperative Monitoring Evaluation and Research
Coastal Nonpoint Program	Coastal Nonpoint Pollution Control Program
CSRI	Coastal Salmon Restoration Initiative
CZARA	Coastal Zone Act Reauthorization Amendments of 1990
DBH	Diameter at breast height
EPA	Environmental Protection Agency
EQC	Environmental Quality Commission
ESA	Endangered Species Act
Federal agencies	National Oceanic and Atmospheric Administration and the U.S. Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FPA	Forest Practices Act
GIS	Geographic information system
GPS	Global Positioning System
ICS	Interagency Coordinating Subgroup
IMST	Independent Multidisciplinary Science Team
kPa	kiloPascal
NCASI	National Council for Air and Stream Improvement
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OAR	Oregon Administrative Rules
ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
OPSW	Oregon Plan for Salmon and Watersheds

Acronym or Abbreviation	Definition
Oregon Plan	Oregon Plan for Salmon and Watersheds
OSDS	Onsite sewage disposal systems
PARC	Pesticide Analytical and Response Center
PCW	Protection of Cold Water
PSP	Pesticide Stewardship Partnership
RipStream	Riparian and Stream Temperature Effectiveness Monitoring Program
State	State of Oregon
TMDL	Total Maximum Daily Load
U.S.	United States
USGS	U.S. Geological Survey

January 30, 2015

NOAA/EPA FINDING THAT OREGON HAS NOT SUBMITTED A FULLY APPROVABLE COASTAL NONPOINT PROGRAM

FOREWORD

This document contains the bases for the finding by the National Oceanic and Atmospheric Administration (NOAA) and the United States (U.S.) Environmental Protection Agency (EPA) (collectively, the federal agencies) that the State of Oregon (State) has not submitted a fully approvable Coastal Nonpoint Pollution Control Program (Coastal Nonpoint Program) as required by section 6217(a) of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA), 16 U.S.C. 1455b. NOAA and EPA arrive at this decision because they find that the State has not adopted additional management measures applicable to forestry that are necessary to achieve and maintain applicable water quality standards under Clean Water Act section 303 and to protect designated uses. NOAA and EPA first identified and notified the State of the need to implement the additional measures in 1998.

On January 13, 1998, the federal agencies approved the Oregon Coastal Nonpoint Program subject to specific conditions (see *Oregon Conditional Approval Findings*). Since then, NOAA and EPA have been working with the State to address the conditions. The State has made incremental modifications to its program and has since met most of those conditions.

On December 20, 2013, the federal agencies provided notice of their intent to find that the State has not fully satisfied the conditions related to new development, onsite sewage disposal systems (OSDS), and additional management measures for forestry (see *Oregon Coastal Nonpoint Program NOAA/EPA Proposed Finding*). The federal agencies invited public comment on the proposed findings, as well as on the extent to which those findings support a finding that the State has not submitted an approvable program under CZARA. Based on comments and concerns the federal agencies received about agriculture nonpoint source management in the State, the federal agencies also invited public comment on the adequacy of the State's programs and policies for meeting the CZARA 6217(g) agriculture management measures and conditions placed on Oregon's Coastal Nonpoint Program. Because the December 20, 2013, notice of intent did not propose a specific decision on whether Oregon had satisfied the CZARA 6217(g) agriculture management measures and the public did not have an opportunity to comment on a specific proposed decision and rationale for that decision, the adequacy of Oregon's agriculture programs is not a basis for the findings that Oregon has not submitted an approvable coastal nonpoint program. (For a summary of the comments received and the federal agencies' response to them, see *NOAA and EPA Response to Comments Regarding the Agencies' Proposed Disapproval Finding that Oregon has Not Submitted a Fully Approvable Coastal Nonpoint Program.*)

In response to NOAA and EPA's proposed findings, Oregon provided an additional submission in support of its coastal nonpoint program on March 20, 2014 (see *Oregon's Response to Proposed Disapproval Findings*).[1]

NOAA and EPA have carefully reviewed the public comments received and the State's March 2014 submission and have made a finding that Oregon has not submitted a fully approvable coastal nonpoint program. This decision is made because the State did not address the additional management measures for forestry condition. Based on information the State provided in March, the federal agencies believe that Oregon has now satisfied the conditions for new development and OSDS, so those conditions are no longer a basis for the finding that Oregon has not submitted an a fully approvable coastal nonpoint program.

For further understanding of terms in this document and the basis of this decision, the reader is referred to the following documents:

- *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* (EPA January 1993);
- *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance* (NOAA and EPA January 1993);
- *Flexibility for State Coastal Nonpoint Programs* (NOAA and EPA March 1995);
- *Final Administrative Changes to the Coastal Nonpoint Pollution Control Program Guidance for Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990* (CZARA) (NOAA and EPA October 1998);
- *Policy Clarification on Overlap of 6217 Coastal Nonpoint Programs with Phase I and II Stormwater Regulations* (NOAA and EPA December 2002); and
- *Enforceable Policies and Mechanisms for State Coastal Nonpoint Source Programs* (NOAA and EPA January 2001).

Electronic copies of the documents cited above as well as any other references cited in this document and the Federal Register notice announcing this action will be available at the following website: http://coast.noaa.gov/czm/pollutioncontrol.

SCOPE OF DECISION

This document explains NOAA and EPA's finding regarding the additional management measures for forestry condition. This finding forms the basis for the federal agencies' decision that the State has not submitted a fully approvable program.[2] The document also notes that the new development and OSDS management measures are no longer a basis for this decision. In addition, the document acknowledges the comments received regarding the adequacy of Oregon's agriculture programs and policies for meeting the 6217(g) agriculture management

[1] In a Settlement Agreement entered in 2010 to resolve a lawsuit brought by a nonprofit organization, Northwest Environmental Advocates v. Locke, et al., Case No. CV09-0017-PK (D. Ore), NOAA and EPA agreed to make a final decision on whether to approve or disapprove Oregon's Coastal Nonpoint Program by May 15, 2014, later extended to January 30, 2015.

[2] CZARA provides for NOAA and EPA to withhold a portion of CZMA Section 306 and CWA Section 319 grant funds when a disapproval decision is made. NOAA and EPA may withhold funding as early as July 1, 2015.

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measures and conditions placed on Oregon's Coastal Nonpoint Program. However, at this time, the agencies have not made a decision on the adequacy of the agricultural measures.

NOAA and EPA's findings in this document are based on information the State has submitted in support of each condition, the federal agencies' knowledge of coastal nonpoint source pollution management in Oregon, and the public comments received. Oregon may–and is encouraged to–continue to work on and improve its program to satisfy all coastal nonpoint program requirements. Should the State submit subsequent information upon which NOAA and EPA determine that the State has submitted a fully approvable program, the federal agencies will provide another opportunity for public comment. At that time, the public will be asked to provide comment on whether the State has satisfied all conditions placed on its program in 1998 and met all CZARA requirements.

FINDING OF NOT HAVING SUBMITTED A FULLY APPROVABLE PROGRAM

NOAA and EPA have determined that the State of Oregon has not submitted a fully approvable program pursuant to Section 6217(a) of CZARA.

I. UNMET CONDITION

A. ADDITIONAL MANAGEMENT MEASURES– FORESTRY

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PURPOSE OF MANAGEMENT MEASURE: The purpose of this management measure is to identify additional management measures necessary to achieve and maintain applicable water quality standards and protect designated uses for land uses where the 6217(g) management measures are already being implemented under existing nonpoint source programs but water quality is still impaired due to identified nonpoint sources.

CONDITION FROM JANUARY 1998 FINDINGS: Within two years, Oregon will identify and begin applying additional management measures where water quality impairments and degradation of beneficial uses attributable to forestry exist despite implementation of the 6217(g) measures (1998 Findings, section X).

Comment [KA1]: Just want to verify that this is correct and not a placeholder for a number.

FINDING: Oregon has not satisfied this condition. By not adopting and implementing additional management measures applicable to forestry and forested lands that are necessary to achieve and maintain water quality standards and to protect designated uses, Oregon has not submitted a fully approvable program under CZARA.

RATIONALE: Oregon proposed to address the additional management measures for forestry condition through a combination of regulatory and voluntary programs. Those measures include best management practices or other control measures by rule established by the Board of Forestry (Board). In addition, the Environmental Quality Commission (EQC), the rulemaking body for the Oregon Department of Environmental Quality (ODEQ), can petition the Board if it

believes the Forest Practices Act (FPA) rules are not adequate for achieving water quality standards. While Oregon has made some progress towards meeting this condition, the State has not identified or applied additional management measures that fully address the program weaknesses the federal agencies noted in the January 13, 1998, Findings for Oregon's Coastal Nonpoint Program. Specifically, the State has not implemented or revised management measures, backed by enforceable authorities, to (1) protect riparian areas for medium-sized and small fish-bearing (type "F") streams and non-fish-bearing (type "N") streams; (2) address the impacts of forest roads, particularly on so-called "legacy" roads; (3) protect high-risk landslide areas; and (4) ensure adequate stream buffers for the application of herbicides, particularly on non-fish-bearing streams.

Protection of Riparian Areas: Oregon relies on both regulatory and voluntary measures to provide riparian protections for medium-sized and small fish-bearing streams (type "F" streams) and non-fish-bearing streams (type "N" streams). Generally, under the State's current FPA rules, no tree harvesting is allowed on private lands within 20 feet of fish-bearing streams, or medium-sized and large non-fish-bearing streams. Also, all snags and downed wood that do not represent a safety or fire hazard must be retained within riparian management areas around small and medium-sized fish-bearing streams (from the stream edge out to 50 and 70 feet, respectively). In addition, the FPA rules establish conifer basal area and density targets for some riparian management areas. For example, along medium-sized fish-bearing streams, there is a requirement to leave 30 trees (at least 8 inches diameter at breast height [DBH]) per 1,000 feet. Oregon has no vegetation retention requirements for small non-fish-bearing streams in the Coast Range and Western Cascades.

In addition to regulatory requirements, the forestry industry in the State of Oregon has adopted voluntary measures to protect riparian areas for high aquatic potential streams (i.e., streams with low gradients and wide valleys where large woody debris recruitment is most likely to be effective at enhancing salmon habitat). These voluntary measures include large wood placement, retaining additional basal area within stream buffers, large tree retention, and treating large and medium-sized non-fish-bearing streams the same as fish-bearing streams for buffer retentions.[3]

Based on the results of a number of studies including those summarized below, NOAA and EPA previously determined and continue to find that additional management measures (beyond those in FPA rules and the voluntary program) for forestry riparian protection around medium-sized and small fish-bearing streams and non-fish-bearing streams are necessary to attain and maintain water quality standards and to protect designated uses. Therefore, Oregon must still adopt and implement management measures applicable to the forestry land use and forested areas in order to protect small and medium-sized fish-bearing streams and non-fish-bearing streams from water quality impairments attributable to forestry practices in riparian areas.

A significant body of science, including 1) the Oregon Department of Forestry (ODF) Riparian and Stream Temperature Effectiveness Monitoring Project (RipStream)[4]; 2) "*A Statewide*

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[3] According to Oregon's March 2014 coastal nonpoint program submittal, information on voluntary efforts was reported to the Oregon Watershed Restoration Inventory. http://coastalmanagement.noaa.gov/nonpoint/oregonDocket/StateofOregonCZARAsubmittal3-20-14.pdf.

[4] Three peer-reviewed articles present the results of the RipStream analysis:

Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality" (i.e., the "*Sufficiency Analysis*")[5]; and 3) the Governor's Independent Multidisciplinary Science Team (IMST) Report on the adequacy of the Oregon forest practices in recovering salmon and trout[6], indicates that riparian protection around small and medium-sized fish-bearing streams and non-fish-bearing streams in Oregon is not sufficient to achieve and maintain water quality and protect designated uses. The 2011 RipStream reports found that FPA riparian protections on private forest lands did not ensure achievement of the Protection of Cold Water (PCW) criterion under the Oregon water quality standard for temperature.[7,8] The PCW criterion prohibits human activities (e.g., timber harvest) from increasing stream temperatures by more than 0.3°C at locations critical to salmon, steelhead, or bull trout. The RipStream analysis demonstrated that the chance of a site managed using FPA rules exceeding the PCW criterion between a pre-harvest year and a postharvest year was 40 percent.[9,10]

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The RipStream study also demonstrated that stream temperature fluctuations increased, in part, with a reduction in shade, and that shade was best predicted by riparian basal area and tree height. The findings suggest that riparian protection measures that maintain higher shade (such as measures implemented on State forest land) are more likely to maintain stream temperatures similar to control conditions.[11]

The 2002 Sufficiency Analysis found that the Oregon FPA's prescribed riparian buffer widths for small and medium-sized fish-bearing streams may be inadequate to prevent temperature impacts. That analysis concluded that 1) FPA standards for some medium-sized and small Type F streams in western Oregon may result in short-term temperature increases at the site level; and 2) FPA standards for some small Type N streams may result in short-term temperature increases at the site level that may be transferred downstream (this may impact water temperature and cold-water refugia) to fish-bearing streams.[12] In water bodies colder than the numeric criteria, temperature increases of 0.3°C measured for all sources combined at the point of maximum impact where salmon, steelhead, or bull trout are present is a violation of the State's PCW criterion.

Dent, L., D. Vick, K. Abraham, S. Shoenholtz, and S. Johnson. 2008. Summer temperature patterns in headwater streams of the Oregon Coast Range. *Journal of the American Water Resources Association* 44:803–813.

Groom, J.D., L. Dent, and L.J. Madsen. 2011a. Stream temperature change detection for state and private forests in the Oregon Coast Range. *Water Resources Research* 47 W01501. doi:10.1029/2009WR009061.

Groom, J.D., L. Dent, and L.J. Madsen. 2011b. Response of western Oregon stream temperatures to contemporary forest management. *Forest Ecology and Management*. doi:10.1016/j.foreco.2011.07.012.

[5] Oregon Department of Forestry and Oregon Department of Environmental Quality. 2002. *Sufficiency Analysis: A Statewide Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality*. Oregon Department of Forestry and Oregon Department of Environmental Quality.

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[6] Independent Multidisciplinary Science Team. 1999. *Recovery of Wild Salmonids in Western Oregon Forests: Oregon Forest Practices Act Rules and the Measures in the Oregon Plan for Salmon and Watersheds*. Technical Report 1999-1 to the Oregon Plan for Salmon and Watersheds, Governor's Natural Resources Office, Salem, OR.

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[7] Groom~~, J.D., Dent, L., Madsen, L.J. 2011. Stream temperature change detection for state and private forests in the Oregon Coast Range. *Water Resources Research* 47 W01501. doi:10.1029/2009WR009061~~ et al., 2011a.

[8] Daugherty, P., and J.D. Groom~~, J.D.~~, 2011. *Update on Private Forests Riparian Function and Stream Temperature (RipStream) Project*. Staff Report; November 3, 2011.

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[9] Ibid. 2.

[10] Groom~~, J.D., Dent, L., Madsen, L.J., 2011. Stream temperature change detection for state and private forests in the Oregon Coast Range. *Water Resources Research* 47 W01501. doi:10.1029/2009WR009061~~ et al., 2011a.

[11] Ibid.2. 3.

[12] Oregon Department of Forestry and Oregon Department of Environmental Quality, 2002, ~~Sufficiency Analysis: A Statewide Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality. Oregon Department of Forestry and Oregon Department of Environmental Quality,~~ pp. 44-45.

As early as 1999, the IMST study found that the FPA rule requirements related to riparian buffers and large woody debris needed to be improved. Based on its scientific analysis, the IMST team concluded, "…the current site-specific approach of regulation and voluntary action is not sufficient to accomplish the recovery of wild salmonids."[13] The IMST team made the following recommendations: 1) Because nongame fish and other aquatic organisms play a role in a functioning stream system, and the distribution of salmonids will change over time, non-fish-bearing streams should be treated no differently than fish-bearing streams when determining the buffer width protections;[14] 2) there should be an increase in the basal area and requirements for riparian management areas for both small and medium-sized streams, regardless of the presence of fish; and 3) there should be an increase in the number of trees within the riparian management area for both fish- and non-fish-bearing small and medium-sized streams.[15]

In 2013, the EPA, together with the U.S. Geological Survey (USGS) and the Bureau of Land Management, reevaluated and summarized pertinent scientific theory and empirical studies to address the effects of riparian management strategies on stream function, with a focus on temperature.[16] With regard to no-cut buffers adjacent to clearcut harvest units, the paper noted that substantial adverse effects from reduced available shade have been observed with no-cut buffers ranging from 20 to 30 meters,[17] and that minimal adverse effects on stream shading and temperature have been observed in studies that examined no-cut buffer widths of 46 meters.[18] For no-cut buffer widths of 46–69 meters, the effects of tree removal on shade and temperature were either not detected or were minimal.[19] The paper also documented that, with no-cut buffer widths of less than 20 meters, pronounced reductions in shade and increases in temperature occurred, as compared to wider buffers. The most dramatic effects were observed at the narrowest buffer widths (less than or equal to 10 meters).[20] As already noted, existing FPA standards for small and medium-sized fish-bearing streams require only 20-foot (or approximately 7-meter) no-cut buffers within a riparian management zone of approximately 17–23 meters. No vegetation retention is required on small non-fish-bearing streams in the Coast Range and Western Cascades.

Oregon also has been investing in three paired watershed studies that are designed to analyze the effects of timber harvesting on a watershed and reach scale.[21] Several commenters have cited the paired watershed study as evidence that the current FPA practices for riparian protection are effective at achieving and maintaining water quality standards and protecting designated uses. Unpublished preliminary data from the Hinkle Creek study indicate that changes in stream temperature after timber harvest along non-fish-bearing streams were variable. In addition, there was no measureable downstream effect on temperatures.[22] The variation in stream temperature

[13] Independent Multidisciplinary Science Team. 1999. 2.
[14] Ibid. 21 and 43.
[15] Ibid. -44-45.
[16] Leinenbach, P., G. McFadden, and C. Torgersen. 2013. *Effects of Riparian Management Strategies on Stream Temperature*. Prepared for the Interagency Coordinating Subgroup (ICS), 22 pp.
[17] Brosofske et al., 1997; Kiffney et al., 2003; Groom et al., 2011b as cited in Leinenbach et al. 2013.
[18] Science Team Review, 2008; Groom et al., 2011a as cited in Leinenbach et al. 2013.
[19] Anderson et al., 2007; Science Team Review, 2008; Groom et al., 2011a; Groom et al., 2011b as cited in Leinenbach et al. 2013.
[20] Jackson et al., 2001; Curry et al., 2002; Kiffney et al., 2003; Gomi et al., 2006; Anderson et al., 2007 as cited in Leinenbach et al. 2013.
[21] Watershed Research Cooperative. Accessed 2014. Watershed Studies. Available online at: http://watershedsresearch.org/watershed-studies/.
[22] Watersheds Research Cooperative, 2008. *Hinkle Creek Paired Watershed Study*. Available online at: http://oregonforests.org/sites/default/files/publications/pdf/WRC_Hinkle.pdf.

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and overall net observed temperature decrease, however, could be attributable to increased slash debris along the stream after harvest, as well as a likely increase in stream flow post-harvest that could reduce any increase in temperatures and contribute to lower mean stream temperatures.[23] Because a variety of factors confound the draft conclusions from the Hinkle Creek study, NOAA and EPA do not rely on that analysis. In its evaluation of the study results, DEQ concluded that temperature data from the Hinkle Creek and Alsea River studies show that for fish-bearing streams, temperature increases downstream from the harvest sites were very similar to the increases found in the RipStream study.[24] The 2011 RipStream reports found that FPA riparian protections on private forest lands did not ensure achievement of the PCW criterion under the Oregon water quality standard for temperature.[25,26]

NOAA and EPA acknowledge that Oregon is working to address some of the inadequate riparian protection measures in the FPA. The Board has the authority to regulate forest practices through administrative rule making and require changes to the FPA rules to protect small and medium-sized fish-bearing streams. Recognizing the need to better protect small and medium Type F streams, the Board directed ODF to undertake a rule analysis process that could lead to revised riparian protection rules. At its September 2014 meeting, the Board voted unanimously in favor of continuing to analyze what changes might be needed in the Oregon Forest Practice Rules to provide greater buffer protection for medium-sized and small fish-bearing streams on private forest lands. NOAA and EPA encourage the State to move forward with this rule-making process expeditiously.

The Board and ODF have not proposed increased protection for riparian areas around small non-fish-bearing streams. As previously discussed in the IMST study, non-fish-bearing streams should be treated no differently than fish-bearing streams when determining the appropriate buffer width required to protect designated uses.[27] Oregon should revise and implement additional management measures for riparian areas adjacent to small non-fish-bearing streams necessary to achieve and maintain water quality standards and protect designated uses. These measures may be regulatory or voluntary, however voluntary measures must be monitored for effectiveness and backed up by enforcement authorities should voluntary measures not be implemented or effective.

Impact of Forestry Roads: In the 1998 approval conditions, NOAA and EPA identified specific concerns with Oregon's FPA rules concerning road density and maintenance, particularly with respect to so-called "legacy" roads. The federal agencies noted that "legacy" roads—roads constructed and used prior to adoption of the FPA in 1971 and not used or maintained since—were not required to be treated and stabilized before closure. In some locations, that practice has resulted in significantly altered surface drainage, diversion of water from natural channels, and

[23] Kibler, K.M. 2007. *The Influence of Contemporary Forest Harvesting on Summer Stream Temperatures in Headwater Streams of Hinkle Creek, Oregon*. Master's thesis, Oregon State University. ~~http://watershedsresearch.org/assets/reports/WRC_Kibler.Kelly_2007_Thesis.pdf.~~

[24] Seeds, J., R. Mitchie, D. Jepsen. and G. Foster~~E. Foster, ODEQ, and D. Jepsen~~. 2014. *Responses to Questions/Concerns Raised by Oregon Forestry Industries Council Regarding the Protecting Cold Water Criterion of Oregon's Temperature Water Quality Standard*. Oregon Department of Environmental Quality and Oregon Department of Fish and Wildlife Memo. June 19, 2004~~06/19/2014~~.

[25] Groom~~, J.D., Dent, L., Madsen, L.J. 2011. Stream temperature change detection for state and private forests in the Oregon Coast Range. *Water Resources Research* 47 W01501, doi:10.1029/2009WR009061~~ et al., 2011a.

[26] Daugherty and Groom, 2011.~~Groom, J.D., 2011. Update on Private Forests Riparian Function and Stream Temperature (RipStream) Project. Staff Report, November 3, 2011. Oregon Department of Forestry.~~

[27] Independent Multidisciplinary Science Team~~.~~, 1999.

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serious erosion or landslides, conditions that threaten to impair coastal waters and protect designated uses.

Legacy roads threaten water quality standards and designated uses due to their location and construction. Historic settlement patterns and relative ease-of-construction led early developers to preferentially locate roads in valley bottoms near streams. Those roads often paralleled low gradient streams (historically the most productive coho habitat) and crossed many tributaries.[28] Prior to modern best management practices, mid-slope roads would often be connected to the valley bottom roads to access harvest units.[29] The poorly designed forest roads increase sediment supplied to streams by altering hillslope hydrology, surface runoff, and sediment flux.[30]~~,31,32,33,34~~ They represent a chronic source of low-level sediment over time.[35] The ecological consequences of sediment continuously supplied from roads may be equally or even more detrimental over time than periodic sediment pulses.[36] Furthermore, legacy roads sometimes serve as initiation points for landslides many years, or even decades, after construction.[37] For example, one study found that forestry roads in Oregon built before 1984 have higher landslide rates than those built later.[38]

Oregon's IMST found that:

> "'Old roads and railroad grades' on forestlands, sometimes called legacy roads, are not covered by the OFPA rules unless they are reactivated for a current forestry operation or purposes. IMST believes the lack of a mechanism to address the risks presented by such roads is a serious impediment to achieving the goals of the Oregon Plan. A process that will result in the stabilization of such roads is needed, with highest priority attention to roads in

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[28] Nicholas J., B. McIntosh, ~~B.~~ and E. Bowles. 2005. *Oregon Coastal Coho Assessment. ~~Coho Assessment~~ Part 1: Synthesis of the Coastal Coho ESU Assessment*. Oregon Watershed Enhancement Board and Oregon Department of Fish and Wildlife, Salem, ~~Oregon~~OR. 69 pp.

[29] Wemple, B.C., F.J. Swanson, ~~F.J.~~ and J.A. Jones~~, J.A.~~, 2001. Forest roads and geomorphic process interactions, Cascade range, Oregon. *Earth Surface Processes and Landforms* 26:~~, pp.~~ 191-204.

[30] Reid, L., M. and T.~~,~~ Dunne~~, T.~~, 1984. Sediment production from forest road surfaces. *Water Resources Research* 20(11):~~,~~ 1753-1761; ~~,~~ Luce, C.H., and T.A. Black. 1999. Sediment production from forest roads in western Oregon. *Water Resources Research* 35(8):2561-2570; Wemple, B.C., and J.A. Jones. 2003. Runoff production on forest roads in a steep, mountain catchment. *Water Resources Research* 39, doi:10.1029/2002WR001744; Skaugset, A., and M.M. Allen. 1998. *Forestry Road Sedimentation Drainage Monitoring Project for Private and State Lands in Western Oregon*. Prepared for the Oregon Department of Forestry by the Forestry Engineering Department, Oregon State University; Robison, E.G., K. Mills, J. Paul, L. Dent, and A. Skaugset. 1999. *Storm Impacts and Landslides of 1996: Final Report*. Forest Practices Technical Report, Vol. 4. Oregon Department of Forestry, Corvallis.

[31] ~~Luce, C.H., Black, T.A., 1999. Sediment production from forest roads in western Oregon. *Water Resources Research* 35(8), 2561-2570.~~

[32] ~~Wemple, B.C., Jones, J.A., 2003. Runoff production on forest roads in a steep, mountain catchment. *Water Resources Research* 39, doi:10.1029/2002WR001744.~~

[33] ~~Skauget, A. and M. M. Allen. 1998. Forestry Road Sedimentation Drainage Monitoring Project for Private and State Lands in Western Oregon. Prepared for the Oregon Department of Forestry by the Forestry Engineering Department, Oregon State University, February 20, 1998.~~

[34] ~~Robison, E.G., Mills K., Paul, J. Dent, L. and A Skaugset. 1999. Storm Impacts and Landslides of 1996: Final Report, Forest Practices Technical Report, vol. 4Oregon Department of Forestry, Corvallis. 145 pp.~~

[35] MacDonald, L.H. and D.B.R. Coe. 2008. Road sediment production and delivery: processes and management. *Proceedings of the First World Landslide Forum, International Programme on Landslides and International Strategy for Disaster Reduction*, United Nations University, Tokyo, Japan.- pp. 381–384.

[36] Detenbeck, N.E~~.,~~, P.W. Devore, G.J. Niemi, and A. Lima. 1992. Recovery of temperate stream fish communities from disturbance: a review of case studies and synthesis of theory. *Environ. Manage*. 16:33-53.

[37] Oregon Department of Forestry and Oregon Department of Environmental Quality~~.~~, 2002. ~~Sufficiency Analysis: A Statewide Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality, Oregon Department of Forestry and Oregon Department of Environmental Quality. October 2002.~~

[38] ~~Oregon Department of Forestry and Oregon Department of Environmental Quality. 2002. Sufficiency Analysis: A Statewide Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality, Oregon Department of Forestry and Oregon Department of Environmental Quality~~Ibid., p. 33, Sessions, 1987.

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core areas, but with attention to such roads and railroad grades at all locations on forestlands over time."[39]

In 1996, the National Marine Fisheries Service (NMFS) provided a scientific analysis of the draft Coastal Salmon Restoration Initiative (CSRI) report—which later evolved into the Oregon Plan for Salmon and Watersheds. NMFS indicated that the forest practice rules have no well-defined process to identify problems with older logging roads and railroad grades constructed prior to 1994.[40]

In addition to water quality impacts, sedimentation and erosion from forestry roads have adverse impacts on salmon. Salmonid spawning is one of Oregon's designated uses. Logging roads are a source of fine sediments that enter spawning gravel and can lower the success of spawning and recruitment for coho salmon.[41] NMFS's scientific analysis for their Endangered Species Act (ESA) section 7 listing for Oregon coast coho salmon also continues to recognize forestry roads, including legacy roads, as a source of sediment and a threat to Oregon coastal coho salmon. NMFS explained that "existing and legacy [forestry] roads can contribute to continued stream degradation over time through restriction of debris flows, sedimentation, restriction of fish passage, and loss of riparian function."[42]

Since 1998, the Board has made several improvements to general road maintenance measures to improve water quality. Changes made in 2002 and 2003 included (1) establishment of a *Avoiding Roads in Critical Locations* ~~Critical Locations~~ Policy to avoid building roads in critical locations (e.g., high-hazards landslide areas, steep slopes, or within 50 feet of water bodies); (2) creation of additional rules to address wet-weather hauling (OAR 629-625-0700); and (3) revision of an existing road drainage rule to reduce sediment delivery (OAR 629-625-0330). Those improvements should reduce sedimentation on roadways in forested areas in order to achieve water quality standards and to protect designated uses. The new drainage requirements, however, become operative only when new road construction or reconstruction of existing roads occurs. The rule changes and new policies do not address legacy roads (i.e., roads that do not meet current State requirements with respect to siting, construction, maintenance, and road drainage) or impairments associated with a large portion of the existing road network where construction or reconstruction is not proposed.

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Oregon proposed to address those legacy road issues and gaps in its FPA rules through voluntary efforts, including restoration and monitoring activities carried out through the voluntary Oregon Plan. For example, in its March 2014 submittal in response to NOAA and EPA's proposed

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[39] Independent Multidisciplinary Science Team. 1999. ~~Recovery of Wild Salmonids in Western Oregon Forests: Oregon Forest Practices Act Rules and the Measures in the Oregon Plan for Salmon and Watersheds. Technical Report 1999-1 to the Oregon Plan for Salmon and Watersheds, Governor's Natural Resources Office, Salem, OR.~~ pp. 47.

[40] NOAA National Marine Fisheries Service. 1996. *Analysis of the Oregon Department of Forestry's (ODF) Most Recent Submission for the State of Oregon's Coastal Salmon Restoration Initiative*. September 10, 1996 memo from Rowan Baker to Steve Morris and Elizabeth Garr.

[41] Cederholm, C.J., L.M. Reid, ~~L.M.~~ and E.O. Salo~~, E.O~~. 1980. *Cumulative Effects of Logging Road Sediment on Salmonid Populations in the Clearwater River, Jefferson County, Washington*. Contribution No. 543. College of Fisheries, University of Washington, Seattle, WA.

[42] NOAA National Marine Fisheries Service. 2012. *Scientific Conclusions of the Status Review for Oregon Coast Coho Salmon (Oncorhynchus kisutch)*. NOAA Technical Memorandum NMFS-NWFSC-118, June 2012. Pg. 78. ~~*Scientific Conclusions of the Status Review for Oregon Coast Coho Salmon* (*Oncorhynchus kisutch*). NOAA Technical Memorandum NMFS-NWFSC-118, June 2012, p. 78. http://www.nwfsc.noaa.gov/assets/25/1916_08132012_121939_SROregonCohoTM118WebFinal.pdf.~~

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determination, the State described ODF's voluntary Road Hazard and Identification and Risk Reduction Project through which private and State forestland owners survey their road networks to identify roads that pose risks to salmonid habitat and prioritize roads for remediation. While Oregon reports that thousands of road miles have been inspected and repaired across the State since the inception of the program in 1997, Oregon does not have a monitoring or tracking program that can report on the significance of these efforts relative to the universe of the road network, nor report on whether these projects addressed active forest roads and roads retired according to current FPA practices, and which projects addressed problems associated with older, legacy roads. As noted in the Oregon Coastal Coho Assessment,[43] old roads make up the majority of forest roads and the road inventory data on private land is often not made available. As a result, it is not possible to determine the extent to which voluntary efforts have addressed the sedimentation problems and landslide risk posed by the legacy road network.

The federal agencies are also concerned about the long-term implementation of the voluntary program. As noted in the State's March 2014 submission, "voluntary reporting of OPSW [Oregon Plan for Salmon and Watersheds] voluntary measures has diminished in the past years, however it is reasonable to assume that voluntary measure implementation has not." The State does not provide the basis for this statement. Without methods for tracking and evaluating the effectiveness of those voluntary programs, the federal agencies cannot approve the voluntary approach for addressing the forestry management measures as they pertain to old or legacy roads.

Oregon also noted that it has entered into a cooperative agreement with the U.S. Forest Service to update the State's geographic information system (GIS) data layer for forest roads. The data layer will help the State conduct a rapid road survey to evaluate and prioritize road risks to soil and water resources. Oregon noted it hoped to begin the survey in 2014. NOAA and EPA encourage the State to move forward with the road survey. However, the federal agencies are not aware if the GIS data layer and the survey will include (or even identify) legacy roads or whether the State will use the data to direct future management actions.

In addition, the State also discussed it was undertaking a third-party audit in 2014 to assess compliance with the FPA rules governing forest road construction and maintenance among other issues. While NOAA and EPA encourage the State to continue to conduct that and other audits to assess compliance with FPA rules, as noted earlier, legacy roads are not subject to FPA rules. Since the audit will assess compliance with the FPA rules, NOAA and EPA conclude that issues resulting from legacy roads as well as issues resulting from general road maintenance where construction or reconstruction is not occurring will not be addressed in this audit since the FPA rules do not apply in these situations.

In summary, NOAA and EPA recognize that legacy roads are being addressed through voluntary measures and that they have been the target of significant landowner investment. As noted in the

[43] Nicholas~~, J., B. McIntosh, and E. Bowles~~ et al., 2005. ~~Oregon Coastal Coho Assessment. Coho Assessment Part 3B. Oregon Watershed Enhancement Board and Oregon Department of Fish and Wildlife, Salem, OR.~~

Oregon Coastal Coho Assessment,[44] however, old roads make up the majority of forest roads, and road inventory data on private land is not widely available. As a result, NOAA and EPA cannot determine, and the State has not made information-based representations specifying, the extent to which voluntary efforts have addressed the sedimentation problems and landslide risk posed by the legacy road network.

In addition, as the federal agencies' *1998 Final Administration Changes Memo* states, in order for states to rely on voluntary programs to meet coastal nonpoint program requirements, a state must, among other things (1) describe the voluntary program, including the methods for tracking and evaluating those programs the State will use to encourage implementation of the management measures; and (2) provide a legal opinion from its Attorney General asserting the State has adequate backup enforcement authority for the voluntary measures and commit to exercising the backup authority when necessary. While the State has provided the federal agencies with a legal opinion detailing the suitability of its backup authorities, it has not demonstrated (either in writing or through past practice) a commitment to exercise its backup authority to require implementation of the additional management measures for forestry roads, as needed, nor identified a prior instance when it may have exercised that authority.

Additionally, the State has not described specifically how voluntary efforts have and will continue to address legacy road issues within the coastal nonpoint management area or how it will continue to monitor and track the implementation of those measures to address forestry road issues, including legacy roads.

The suite of voluntary programs Oregon has described could satisfy the forestry roads element of this management measure. However, as discussed above, additional information is needed at this time. The federal agencies encourage the State to provide a commitment to use its backup authority to ensure implementation of forestry road additional management measures. The agencies also encourage the State to move forward with establishing a road survey or inventory program that considers both active, inactive, and legacy roads, including a mechanism for tracking and monitoring implementation of voluntary measures to carry out identified priority forest road improvements. To support an approvable coastal nonpoint program, the inventory could establish, among other things, a timeline for addressing priority road issues, including retiring or restoring forest roads that impair water quality, and a reporting and tracking component to assess progress for remediating identified forest road problems. Establishing a roads inventory with appropriate reporting metrics would provide valuable information on State and private landowner accomplishments to improve and repair roads and identify where further efforts are needed. Such an approach could help verify whether the combination of current rules and the Oregon Plan's voluntary measures are effective in managing forest roads to protect streams within a reasonable timeframe.

Protection of Landslide-Prone Areas: In the 1998 findings, the federal agencies identified areas where existing practices under the FPA and FPA rules should be strengthened to achieve and

[44] Ibid. ~~Nicholas J., McIntosh, B. and E. Bowles. 2005. Oregon Coastal Coho Assessment. Coho Assessment Part 3B. Oregon Watershed Enhancement Board and Oregon Department of Fish and Wildlife, Salem, Oregon. 49 pp.~~

maintain water quality standards and protect designated uses; among them was the need to provide better protection of areas at high risk for landslides.

Oregon proposed to address the landslide element of the additional management measures for forestry condition through a mix of regulatory and voluntary approaches. Since January 13, 1998, Oregon has amended the Oregon FPA rules to require the identification of landslide hazard areas in timber harvesting plans and road construction and placed certain restrictions on harvest and road activities within the designated high-risk areas for public safety (OAR 629-623-0000 through 629-623-0800). Under these amendments, however, shallow, rapidly moving landslide hazards directly related to forest practices are addressed only as they relate to risks for loss of life and property, not for potential adverse impacts on water quality or designated uses. Timber harvest and the construction of forest roads, when alternatives are not available, continue without controls on high-risk landslide hazard areas as long as such harvest and road construction are not deemed a public safety risk.

In addition to the regulatory programs, Oregon stated that it employs a voluntary measure under the Oregon Plan that gives landowners credit for leaving standing live trees along landslide-prone areas as a source of large wood. The large wood, which may eventually be deposited into fish-bearing stream channels, contributes to stream complexity, a key limiting factor for coastal coho salmon recovery. While this is a good management practice, the measure is not designed to protect high-risk erosion areas but rather to ensure large wood is available to provide additional stream complexity when a landslide occurs. NOAA and EPA do not consider this voluntary action a sufficient management measure to reduce high-risk landslides that adversely affect water quality standards or designated uses.

Also, Oregon's voluntary program is incomplete. To rely on voluntary approaches to meet CZARA requirements, a state not only needs to describe the voluntary approach but also needs to describe how it will monitor and track implementation of that approach, provide a legal opinion asserting the state has adequate backup authority to ensure implementation of the management measure, and provide a commitment to use that backup authority, when needed.

As noted in the January 13, 1998, findings, logging on unstable steep terrain can increase landslide rates, which contributes to water quality impairments. A number of studies continue to show significant increases in landslide rates after clearcuts compared to unmanaged forests in the Pacific Northwest. For example, one study found that in three out of four areas studied in very steep terrain, landslide densities and erosion volumes were greater in stands that were clearcut during the previous nine years.[45] The study observed that landslide rates on Mettman Ridge, within the Oregon Coast Range, increased three to nine times the background rate after clearcut harvest. Another study performed a regional analysis from the Mettman Ridge study and found that forest clearing dramatically accelerates shallow landslides in steep terrain

[45] Robison~~, G.R., Mills, K.A., Paul, J. Dent, L. and A. Skaugset~~ et al., 1999. ~~Oregon Department of Forestry Storm Impacts and Landslides of 1996: Final Report. Oregon Department of Forestry Forest Practices Monitoring Program. Forest Practices Technical Report Number 4.157 pages.~~

typical of the Pacific Northwest.[46] In another study in southwestern Washington, landslide densities in recently harvested sites were roughly two to three times the landslide densities in old stands when exposed to rainfall intensities greater than the 100-year event.[47] That research found that very few landslides occurred when rainfall was less than or equal to a 100-year rainfall event.

Other research has examined the role of root cohesion on landslide susceptibility in forested landscapes. "Root cohesion" is a measure of the lateral reinforcing strength the root system provides. The higher the root cohesion, the better the root system can stabilize the soil, reducing the risk of landslides.[48] One study noted that median lateral root cohesion is less for industrial forests with significant understory and deciduous vegetation (6.8–23.2 kiloPascal (kPa), a unit of pressure) compared to natural forests dominated by conifers (25.6–94.3 kPa). Additionally, in clearcut areas, the researchers found that lateral root cohesion is uniformly less than or equal to 10 kPa, making those areas much more susceptible to landslides.

Sakals and Sidle modeled the effect of different harvest methodologies on root cohesion over time.[49] They found that, of the methodologies examined (i.e., clearcutting, single-tree selection cutting, and strip cutting), clearcuts produced the greatest decline in root cohesion. Further, they found that root cohesion may continue to decline for 30 years postharvest. That decline is attributed to the decay of the root systems of the harvested trees and the fact that young root systems have smaller root volumes and less radial rooting extent. They concluded that clearcuts on hazardous slopes could increase the number of landslides as well as the probability of larger landslides. They also stated that a management approach requiring the retention of conifers on high-risk slopes would increase root cohesion and reduce the risk of landslides.

The peer-reviewed science demonstrates that timber harvesting in landslide-prone areas degrades water quality and impairs designated uses in Pacific Northwest streams by delivering excessive sediment load that can block fish passage and smother or scour spawning grounds. Whittaker and McShane explained:

> "In the Pacific Northwest, … [l]andslides alter aquatic habitats by elevating sediment delivery, creating log jams, and causing debris flows that scour streams and stream valleys down to bedrock (Rood 1984; Cederholm and Reid 1987; Hogan et. al. 1998). The short-term and long-term impacts of higher rates of landslides on fish include habitat loss, reduced access to spawning and rearing sites, loss of food resources, and direct mortality (Cederholm and Lestelle 1974; Cederholm and Salo 1979; Reeves et. al. 1995). The restoration of geomorphic processes to natural disturbance regimes is crucial to the recovery of endangered salmonids (*Oncorhynchus* spp.) and other aquatic species in the

[46] Montgomery, D. R., K. M. Schmidt, H. M. Greenberg, ~~&~~ and W. E. Dietrich. 2000. Forest clearing and regional landsliding. *Geology* 28: 311-314.

[47] Turner, T.R., S.D. Duke, ~~S.D.,~~ B.R. Fransen, ~~B.R.,~~ M.L. Reiter, ~~M.L.,~~ A.J. Kroll, ~~A.J.,~~ J.W. Ward, ~~J.W.,~~ J.L. Bach, ~~J.L.,~~ T.E. Justice, ~~T.E.,~~ and R.E. Bilby. 2010. Landslide densities associated with rainfall, stand age, and topography on forested landscapes, southwestern Washington, USA. *Forest Ecology and Management* 259:2233–2247.

[48] Schmidt, K.M., J.J. Roering, ~~J.J.,~~ J.D. Stock, ~~J.D.,~~ W.E. Dietrich, ~~W.E.,~~ D.R. Montgomery~~, D.R.,~~ and T. Schaub~~, T.~~. 2001. The variability of root cohesion as an influence on shallow landslide susceptibility in the Oregon Coast Range~~,~~ *Canada Geotech. J.* ~~Vol.~~ 38: 997-1024.

[49] Sakals, M.E., and R.C. Sidle. 2004. A spatial and temporal model of root cohesion in forest soils. *Canadian Journal of Forest Research* 34(4): 950-958.

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> Pacific Northwest as these species evolved under conditions with much lower sediment delivery and landslide frequency (Reeves et. al. 1995; Montgomery 2004)."[50]

In 2013, the Cooperative Monitoring Evaluation and Research committee (CMER) of the Washington State Department of Natural Resources published a study that explored landslide response to a large 2007 storm in southwestern Washington.[51] Within the 91-square-mile study area, a total of 1,147 landslides were found within harvest units that delivered sediment load to public resources (mostly streams). The majority (82 percent) occurred on hillslopes and the rest initiated from roads. In examining the landslides, the study found that unstable hillslopes logged with no buffer had a significantly higher (65 percent) landslide density than did mature stands. Unstable slopes logged with no buffer also delivered 347 percent more sediment than slopes with unlogged mature stands. The authors conclude that buffers on unstable slopes likely reduce landslide density and sediment volume. That conclusion has important implications for water quality and designated beneficial uses. Sediments delivered from landslides clog and damage fish gills, suffocate fish eggs, smother aquatic insect larvae, and fill in spaces in streambed gravel where fish lay eggs. Sediment can also carry other pollutants into water bodies, creating issues for domestic water supply and public water providers.[52]~~,53,54,55,56,57~~

Given the evidence that clear-cutting increases the rate of landslides and that landslides adversely affect water quality and designated beneficial uses, adoption and implementation of additional management measures applicable to forestry in landslide-prone areas is necessary to achieve and maintain water quality standards and protect designated uses. To develop the required additional management measures, the State could pursue several actions that would collectively address this issue, such as some of the following:

- Adopt harvest and road construction restrictions that apply to all high-risk landslide-prone areas with moderate-to-high potential to impact water quality and designated uses.

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[50] Whittaker, K.A., and D.~~,~~ McShane~~, D.,~~ 2012. Comparison of slope instability screening tools following a large storm event and application to forest management policy. *Geomorphology* 145-146~~, (2012),~~ 115-122.

[51] Stewart, G., J. Dieu, ~~J.,~~ J. Phillips, ~~J.~~ M. O'Connor, ~~M.~~ and C. Veldhuisen ~~C.~~, 2013. *The Mass Wasting Effectiveness Monitoring Project: An examination of the landslide response to the December 2007 storm in Southwestern Washington*~~:~~. Cooperative Monitoring, Evaluation and Research Report CMER 08-802; Washington Department of Natural Resources, Olympia, WA.

[52] Whittaker~~, K.A.,~~ and McShane~~, D.,~~ 2012~~. Comparison of slope instability screening tools following a large storm event and application to forest management policy. *Geomorphology* 145-146 (2012): 115-122.~~; Cederholm et al., 1980; Jensen, D.W., E.A. Steel, A.H. Fullerton, and G.R. Pess, 2009. Impact of fine sediment on egg-to-fry survival of pacific salmon: A meta-analysis of published studies. *Reviews in Fisheries Science* 17(3):348-359; EPA, 2003. *Developing Water Quality Criteria for Suspended and Bedded Sediments (SABS): Potential Approaches (Draft)*. U.S. Environmental Protection Agency; Bauer, S.B., and S.C. Ralph, 1999. *Aquatic Habitat Indicators and their Application to Water Quality Objectives within the Clean Water Act, Section 3*. U.S. Environmental Protection Agency, Region 10. EPA 910-R-99-014; Oregon Department of Environmental Quality. No Date. *Water Quality Standards: Turbidity*. Available at: http://www.deq.state.or.us/wq/standards/turbidity.htm.

~~[53] Cederholm, C.J., Reid, L.M., Salo, E.O. 1980. Cumulative Effects of Logging Road Sediment on Salmonid Populations In The Clearwater River, Jefferson County, Washington. Contribution No. 543, College of Fisheries, University of Washington, Seattle, Washington 98195~~

~~[54] Jensen, D.W., Steel, E.A., Fullerton, A.H., Pess, G.R., 2009. Impact of Fine Sediment on Egg-To-Fry Survival of Pacific Salmon: A Meta-Analysis of Published Studies, *Reviews in Fisheries Science*: 17(3):348-359, Northwest Fisheries Science Center, NOAA Fisheries, Seattle, WA.~~

~~[55] EPA. 2003. "Developing Water Quality Criteria for Suspended and Bedded Sediments (SABS): Potential Approaches (Draft). U.S. Environmental Protection Agency, August 2003.~~

~~[56] EPA and Idaho Water Resources Research Institute. 1999. Aquatic Habitat Indicators and their Application to Water Quality Objectives within the Clean Water Act, Section 3. U.S. Environmental Protection Agency, Region 10, July 1999. p. 20. EPA 910-R-99-014.~~

~~[57] Oregon Department of Environmental Quality, Turbidity Standards, Background Information. http://www.deq.state.or.us/wq/standards/turbidity.htm.~~

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- Develop a scientifically rigorous process for identifying high-risk areas and unstable slopes based on field review by trained staff. The process could include the use of slope instability screening tools to identify high-risk landslide areas that take into account site-specific factors such as slope, geology and geography, and planned land management activities (e.g., roads development).

- Develop more robust voluntary programs to encourage and incentivize the use of forestry best management practices to protect high-risk landslide areas that have the potential to impact water quality and designated uses, such as employing no-harvest restrictions around high-risk areas and ensuring that roads are designed, constructed, and maintained in a manner that minimizes the risk of triggering slope failures. Widely available maps of high-risk landslide areas could improve water quality by informing foresters during harvest planning.

- Institute a monitoring program to track compliance with the FPA rules and voluntary guidance for high-risk landslide-prone areas and the effectiveness of the practices in reducing slope failures.

- Establish an ongoing monitoring program that assesses the underlying causes and water quality impacts of landslides shortly after they occur and generates specific recommendations for future management. Integrate into the Total Maximum Daily Load (TMDL) development process procedures to identify high-risk landslide-prone areas and specific best management practices to protect those areas. For example, in the Mid-Coast Basin, ODEQ is currently developing a sediment TMDL to address water quality limited waters for bio-criteria, turbidity, and sediment. To support the development of the TMDL, the Oregon Department of Geology and Mineral Resources completed landslide inventory maps for two watersheds in the Mid-Coast Basin, finding hundreds of previously unidentified landslides.[58] As part of the TMDL, ODEQ will complete a source assessment of the landslides in relationship to the water quality impairments. NOAA and EPA encourage the State to complete the TMDL and include specific practices that landowners are required to follow in order to reduce pollutants causing impairments addressed in the TMDL.

If Oregon plans to rely on voluntary efforts, the State will need to (1) describe the full suite of voluntary practices it plans to use to address this management measure; (2) describe how it will ensure the use of these voluntary practices and track their implementation; and (3) provide a legal opinion that the State has backup authority to ensure implementation of the management measure and a commitment to use the backup authority, when needed.

Ensure Adequate Stream Buffers for Application of Herbicides, Particularly on Non-fish-bearing (Type N) Streams: In the January 1998 findings, the federal agencies noted that Oregon had

[58] Burns, W. J., S. Duplantis, ~~S.,~~ C. Jones, ~~C.,~~ and J. English~~, J.,~~ 2012. *LIDAR Data and Landslide Inventory Maps of the North Fork Siuslaw River and Big Elk Creek Watersheds, Lane, Lincoln and Benton Counties, Oregon*. Open-File Report O-12-07, Oregon Department of Geology and Mineral Industries.

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adopted forest practices rules that require aerial spray buffers for most pesticide applications (OAR 629-620-0400(7)(b)). The rule changes, however, did not include spray buffers for the aerial application of herbicides along non-fish-bearing streams commonly found in headwaters. NOAA and EPA determined that additional management measures to protect non-fish-bearing streams during the aerial application of herbicides on forestlands were necessary to achieve and maintain water quality standards and to protect designated uses.

Since 1998, Oregon has provided to the federal agencies several documents describing the programs it uses to manage pesticides, most recently in March 2014. In addition to the FPA rule buffers noted above, the State also addresses pesticide issues through the Chemical and Other Petroleum Product Rules (OAR 629-620-0000 through 800) Pesticide Control Law (ORS 634); and best management practices set by the Oregon Department of Agriculture (ODA) and federal pesticide label requirements under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); as well as the State's Water Quality Pesticide Management Plan[59] and Pesticide Stewardship Partnership (PSP) program.[60] In its March 2014 submittal, Oregon noted that it specifically relies on best management practices set by ODA and EPA under FIFRA for the protection of small non-fish-bearing streams.

The aerial application of herbicides such as glyphosate, 2,4-D, atrazine, and others is a common practice in the forestry industry in Oregon.[61,62] Herbicides are sprayed to control weeds on recently harvested parcels to prevent competition with newly planted tree saplings. In 2008, more than 800,000 pounds of pesticides, the majority of which were herbicides (at least 700,000 pounds) were used for forestry purposes in Oregon.[63] Research has shown that herbicides may adversely impact water quality and designated uses to protect aquatic life.[64,65, 66, 67] Herbicides applied through the air commonly reach nearby streams through aerial drift[68,69 ,70] and runoff from the land.[71,72]

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[59] State of Oregon (ODA, ODEQ, ODF, and OHA)~~ODA, ODEQ, ODF, and OHA~~. 2011. *Pesticide Management Plan for Water Quality Protection*. http://www.oregon.gov/ODA/shared/Documents/Publications/PesticidesPARC/PesticideManagementPlanWaterQuality.pdf.

[60] ODEQ. 2012. *Fact Sheet: Pesticide Stewardship Partnerships in Oregon*. DEQ 12-WQ-021. Updated March. 2012.

[61] Wagner, R. G., M. Newton, E. C. Cole, J. H. Miller, and B. D. Shiver~~Robert G. Wagner, Michael Newton, Elizabeth C. Cole, James H. Miller, and Barry D. Shiver~~. 2009. The role of herbicides for enhancing forest productivity and conserving land for biodiversity in North America. *Wildlife Society Bulletin* 32(4):1028-1041.~~doi:10.2193/0091-7648(2004)032[1028:TROHFE]2.0.CO;2~~

[62] Norris, L.A., H.W. Lorz, and S.V. Gregory. 1991. Forest ~~Chemicals~~chemicals. Influences of f~~F~~orest and r~~R~~angeland m~~M~~anagement on s~~S~~almonid f~~F~~ishes and t~~T~~heir h~~H~~abitats. *American Fisheries Society Special Publication* 19:2-0~~7~~7-296. ~~1991~~.

[63] Oregon Department of Agriculture~~ODA~~. 2009. *Pesticide Use Reporting System. 2008 Annual Report*. Available online at: http://www.oregon.gov/ODA/shared/Documents/Publications/PesticidesPARC/PesticideusereportingsystemAnnualreport2008.pdf~~June 2009.~~

[64] ~~Rick A.~~ Relyea, R.A. 2005. "The i~~I~~mpact of i~~I~~nsecticides and ~~H~~herbicides on the biodiversity and productivity of aquatic communities." *Ecological Applications* 15:618–627. ~~http://dx.doi.org/10.1890/03-5342; http://www.esajournals.org/doi/full/10.1890/03-5342.~~; Relyea, R., and J. Hoverman. 2006. Assessing the ecology in ecotoxicology: a review and synthesis in freshwater systems. *Ecology Letters* 9:1157–1171; Battaglin, W.A., K.C. Rice, M.J. Focazio, S. Salmons, and R.X. Barry. 2009. The occurrence of glyphosate, atrazine, and other pesticides in vernal pools and adjacent streams in Washington, DC, Maryland, Iowa, and Wyoming, 2005-2006. *Environmental Monitoring and Assessment* 155(1-4): 281-307; Graymore, M., F. Stagnitti, and G. Allinson. 2001. Impacts of atrazine in aquatic ecosystems. *Environment International* 26(7-8):483-495.

[65] ~~Relyea, R. and Hoverman, J. (2006). Assessing the ecology in ecotoxicology: a review and synthesis in freshwater systems. *Ecology Letters*, 9: 1157–1171. doi: 10.1111/j.1461-0248.2006.00966.x. http://onlinelibrary.wiley.com/doi/10.1111/j.1461-0248.2006.00966.x/full.~~

[66] ~~Battaglin,W.A. et al. 2009. The occurrence of glyphosate, atrazine, and other pesticides in vernal pools and adjacent streams in Washington DC, Maryland, Iowa, and Wyoming, 2005-2006. Environmental Monitoring and Assessment, vol. 155, 281-307. DOI 10.1007/s10661-008-0435-y. http://download.springer.com/static/pdf/861/art%253A10.1007%252Fs10661-008-0435-y.pdf?auth66=1420487219_acd0a22105b623694ff637e6872270e5e&ext=.pdf.~~

[67] ~~Graymore, Stagnitti, and Allinson 2001. Impacts of atrazine in aquatic ecosystems. http://fn4qj3vk6a.scholar.serialssolutions.com/?sid=google&auinit=M&aulast=Graymore&atitle=Impacts+of+atrazine+in+aquatic+ecosystems&id=doi:10.1016/S0160-4120(01)00031-9&title=Environment+international&volume=26&issue=7&date=2001&spage=483&issn=0160-4120.~~

[68] Majewski, M.S., and P.D. Capel. 1996. *Pesticides in the Atmosphere: Distribution, Trends, and Governing Factors*. U.S. Geological Survey, Open File Report 94-506. National Water-Quality Assessment Program~~Volume 3 of Pesticides in the Hydrologic System Series. Ann Arbor~~

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Oregon does not require spray buffers for aerial application of herbicides on small non-fish-bearing streams. Applicators can spray directly up to and over non-fish-bearing streams. In addition, there are no requirements for riparian harvest buffers along small non-fish-bearing streams. For example, in the Triangle Lake area in the Oregon coastal nonpoint management area, there are areas where aerial application of herbicides occurred in areas where timber was harvested to the stream edge.[73] Riparian harvest buffers could serve as defacto spray buffers since they would prevent timber harvesting up to the stream and, therefore, would not require herbicide spraying over the nonharvested area to control weeds. Riparian buffers can also help filter any herbicide pollutants from runoff before it reaches the streams.[74,75]

Given that non-fish-bearing streams comprise about 70 percent of the total stream length and feed fish-bearing streams, the wide use of herbicides by the forestry industry in coastal Oregon and the lack of any spray or riparian buffers that would help protect non-fish-bearing streams from adverse impacts due to the aerial application of herbicides threaten designated uses in Oregon coastal waters. Small, headwater non-fish-bearing streams play an important role in delivering cold, clean water to downstream fish-bearing streams.[76] Therefore, it is reasonably foreseeable that Oregon coastal waters are threatened by herbicide pollutants and that additional management measures that will provide greater protection of non-fish-bearing streams during the aerial application of herbicides are warranted to achieve water quality standards and protect designated uses (CZARA sec. 6127(b)(1)(B), 16 U.S.C. 1455b).

Other recent studies and reports also support NOAA and EPA's determination that additional management measures for forestry are needed to address aerial herbicide application due to a reasonably foreseeable threat to coastal waters and designated uses. One of the common indirect adverse effects on water quality and designated uses, particularly cold-water fisheries uses, occurs because herbicides can reduce the growth and biomass of primary producers (i.e., algae

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~~Press, Inc., Chelsea, Michigan 28118, 1997.~~; Van Den Berg, F., R. Kubiak, W.G. Benjey, M.S. Majewski, S.R. Yates, G.L. Reeves, J.H. Smelt, and A.M.A. Van Der Linden. 1999. Emis*sions of Pesticides into the Air. Fate of Pesticides in the Atmosphere: Implications for Environmental Risk Assessment*. pp. 195-218; Pimentel, D., and L. Levitan. 1986. Pesticides: amounts applied and amounts reaching pests. *Bioscience* 36(2).

[69] ~~F. Van Den Berg, R. Kubiak, W.G. Benjey, M.S. Majewski, S.R. Yates, G.L. Reeves, J.H. Smelt, A.M.A. Van Der Linden. Fate of Pesticides in the Atmosphere: Implications for Environmental Risk Assessment, Emissions of Pesticides into the Air. 1999, pp. 195-218.~~

[70] ~~D. Pimentel and L. Levitan. Pesticides: amounts applied and amounts reaching pests. *Bioscience*, Vol. 36, no. 2, 1986.~~

[71] Gilliom, R.J., J.E. Barbash, C.G. Crawford, P.A. Hamilton, J.D. Martin, N. Nakagaki, L.H. Nowell, J.C. Scott, P.E. Stackelberg, G.P. Thelin, and D.M. Wolock. ~~Gilliom et al. USGS.~~ 2006. *The Quality in Our Nation's Water: Pesticides in the Nation's Streams and Groundwater, 1992-2001*. Circular 1291. ~~http://pubs.usgs.gov/circ/2005/1291/pdf/circ1291.pdf~~.

[72] Larson, S.J., P.D. Capel, and M. Majewski. 1995. Pesticides in Surface Waters: Distribution, Trends and Governing Factors. *Volume 2 of Pesticides in the ~~Hydroogic~~Hydrologic System Series*. Ann Arbor Press, Inc., Chelsea, MI~~Michigan 28118, 1995~~.

[73] Leinenbach, P. 2015. *Images of forest harvest areas where herbicides were applied using aerial broadcast application methods with helicopters in the Triangle Lake region of the central coast range of Oregon*. Memorandum from P. Leinenbach to A. Henning. January 12, 2015. ~~Memo from P. Leinenbach, P to Alan Henning, EPA re: "Images of forest harvest areas where herbicides were applied using aerial broadcast application methods with helicopters in the Triangle Lake region of the central coast range of Oregon." January 12, 2015.~~

[74] Welsch, D.J. ~~USDA Forest Service.~~ 1991. *Riparian Forest Buffers: Function and Design for Protection and Enhancement of Water Resources*. USDA Forest Service. NA-PR-07-91. ~~https://books.google.com/books?hl=en&lr=&id=rpSNdMJz4XQC&oi=fnd&pg=PP3&dq=buffer+pesticide+forestry&ots=77TENrS6TQ&sig=BH__zajspVeRyeXtEcGq17vZeFE#v=onepage&q=buffer%20pesticide%20forestry&f=false~~.

[75] Kiffney. P.M., J.S. Richardson, and J.P. Bull. 2003. Responses of periphyton and insects to experimental manipulation of riparian buffer width along forest streams. *Journal of Applied Ecology*~~, 2003. Volume~~ 40;~~,~~ 1060-1076. ~~http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2664.2003.00855.x/pdf~~.

[76] Gomi, T., R.C. Sidle,~~, A.~~ and J.S. Richardson. 2002. Understanding pProcesses and dDownstream lLinkages of hHeadwater sSystems. *Bioscience*~~, October 2002, Vol.~~ 52(~~, No.~~ 10). ~~http://bioscience.oxfordjournals.org/content/52/10/905.short~~.

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and phytoplankton) that form the base of the aquatic food chain. A decrease in primary production (e.g., plants and algae) can have significant effects on consumers, such as salmonids and other animals that depend on the primary producers for food.[77] The effects are often reported at herbicide concentrations well below levels that would have a direct effect on consumers. In addition, there are concerns about the increased toxicity of mixtures of herbicides and other pesticides to aquatic organisms.[78~~,79,80~~] EPA's biological evaluation of the effects of 2,4-D[1], a commonly used herbicide, concluded that aerial forestry use is likely to adversely affect the California red-legged frog based on harmful impacts to freshwater fish, which are used as a surrogate for aquatic-phase amphibians. EPA's acute levels of concerns for 2,4-D on freshwater fish were exceeded for the aerial forestry use pattern, based on aquatic exposure modeling assuming the labeled rate of one application at 4 lb acid equivalent (a.e.)/acre and available toxicity data.[81]

A few studies have indicated that aerial application might not result in herbicides exceeding toxic thresholds for humans or aquatic life in fish-bearing and drinking water streams,[82] at the interface of fish- and non-fish-bearing streams,[83] or at drinking water facilities in Oregon.[84] None of the studies, however, were focused on impacts to non-fish-bearing streams and do not provide sufficient evidence, based on other information, that coastal waters and designated uses are not reasonably or foreseeably threatened by the aerial application of herbicides over non-fish-bearing streams. For example, an ODF study that looked at the effectiveness of FPA aerial spray buffers for herbicides and fungicides on fish-bearing streams stated that they could not draw any conclusions about the FPA's effectiveness at protecting water quality for non-fish-bearing streams.[85] A USGS study in the McKenzie River basin looked broadly at urban, forestry, and agriculture pesticide use and the impacts it had on drinking water.[86] The study, which took place outside the coastal nonpoint management area, also notes that forestry sampling was inconsistent because of irregular and intermittent pesticide application patterns among tributaries and the difficulty of capturing runoff events in the spring after application. A National Council for Air and Stream Improvement (NCASI) study in the Needle Branch in the Oregon Coast Range

[77] Marczak, L.B., T. Sakamaki, S. L. Turvey, I. Deguise, S. L. R. Wood, and J. S. Richardson. ~~Laurie B. Marczak, Takashi Sakamaki, Shannon L. Turvey, Isabelle Deguise, Sylvia L. R. Wood, and John S. Richardson~~ 2010. Are forested buffers an effective conservation strategy for riparian fauna? An assessment using meta-analysis. *Ecological Applications* 20:126–134.

[78] Relyea, R.A. 2009. A Cocktail of Contaminants: How mixtures of pesticides at low concentrations affect aquatic communities. *Oecologia*~~, March 2009, Volume~~ 159(~~, Issue 2~~); ~~pp~~ 363-376; ~~Gilliom et al., 2006; Carpenter, K.D., S. Sobeszczyk, A. Arnsberg, and F.A. Rinella. 2008. *Pesticide Occurrence and Distribution in the Lower Clackamas River Basin, Oregon, 2000-2005*. Scientific Investigations Report 2008-5027.~~

[79] ~~Gilliom et al, 2006. Ibid.~~

[80] ~~Carpenter, K.D., S. Sobeszczyk, A. Arnsberg, and F.A. Rinella. USGS. 2008. Pesticide Occurrence and Distribution in the Lower Clackamas River Basin, Oregon, 2000-2005. Scientific Investigations Report 2008-5027.~~

[81] Office of Pesticides Programs. 2009. *Risks of 2,4-D Use to the Federally Threatened California Red-Legged Frog (Rana Aurora draytonii) and Alameda Whipsnake (Masticophis lateralis euryxanthus)*. Pesticides Effects Determination. Environmental Date and Effects Division, Office of Pesticides Programs. ~~February 20, 2009.~~

[82] Dent, L., and J. Robben. 2000. *Oregon Department of Forestry: Aerial Pesticide Application Monitoring Final Report*. Oregon Department of Forestry, Pesticides Monitoring Program. Technical Report 7. ~~March 2000.~~

[83] National Council for Air and Stream Improvement. ~~-~~2013. *Measurement of Glyphosate, Imazapyr, Sulfometuron methyl, and Metsulfuron ~~Mmetfulfuron~~ methyl in Needle Branch Streamwater*. Special Report No. 130-1.

[84] Kelly, V.J., C.W. Anderson, and K. Morgenstern. 2012. *USGS and Eugene Water and Electric Board. Reconnaissance of Land-Use Sources of Pesticides in Drinking Wwater, McKenzie River Basin, Oregon*. Scientific Investigations Report 2012-5091.

[85] Dent ~~L.~~ and ~~J.~~ Robben, 2000. ~~*Oregon Department of Forestry: Aerial Pesticide Application Monitoring Final Report*. Oregon Department of Forestry, Pesticides Monitoring Program. Technical Report 7. March 2000.~~

[86] Kelly et al., ~~V.J., C.W. Anderson, and K. Morgenstern.~~ 2012. ~~USGS and Eugene Water and Electric Board. Reconnaissance of Land-Use Sources of Pesticides in Drinking water, McKenzie River Basin, Oregon. Scientific Investigations Report 2012-5091.~~

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looked at how herbicide levels in streams varied during storm events at three sample sites in harvest units downstream of non-fish-bearing areas where herbicides were applied aerially with no buffers.[87] The sample sites themselves were collected in fish-bearing streams with 50-foot riparian buffers. The study noted clear pulses of herbicides at each storm event with declining levels downstream and over several storms.

Oregon relies on the national best management practices established through the federal FIFRA pesticide labels to protect non-fish-bearing streams. Currently, EPA, NMFS, U.S. Fish and Wildlife Service, and U.S. Department of Agriculture are working to improve the national risk assessment process to include all ESA-listed species when registering all pesticides, including herbicides. Given the scale of this undertaking, the federal agencies are employing a phased, iterative approach during ongoing registration reviews. These ongoing federal processes, however, should not preclude Oregon from pursuing state-level improvements to manage herbicides in the context of its unique forestry landscape and sensitive species.

Oregon and other Pacific Northwest states have determined the importance of state action beyond the national FIFRA label requirements to protect water quality and designated uses, including salmon, in their respective states.[88] Oregon has 60-foot spray buffers for nonbiological insecticides and fungicides on non-fish-bearing streams (OAR 629-620-400(7)) and 60-foot spray buffers for herbicides on wetlands, and fish-bearing and drinking water streams (OAR 629-620-400(4)). Other Pacific Northwest states have established more stringent forestry spray buffer requirements for herbicides along non-fish-bearing streams. For example, for smaller non-fish-bearing streams, Washington maintains a 50-foot riparian and spray buffer (WAC-222-38-040). Idaho has riparian and spray buffers for non-fish-bearing streams of 100 feet (IAR 20-02-01). California sets riparian buffers for non-fish-bearing streams after consulting with the local forester, which implicitly restricts the aerial application of herbicides near the stream (14 CCR 4).

Though Oregon has neither spray nor riparian harvest buffers for herbicides that are aerially applied on small non-fish-bearing streams, the ODA Pesticide Division requires applicators to attend training and obtain licenses prior to spraying pesticides. ODF requires pesticide applicators to complete a Notification of Operation at least 15 days before applying on forestlands[89] and to maintain a daily chemical application form.[90] On the Notification of Operation form, the applicators must list which pesticides *might* be applied, the stream segments on which the pesticides *might* be applied, and when application *might* occur within a 2–3 month period. The notification form does not, however, specify when application will occur within a 1–2 week period or postapplication, the pesticides that were applied and how much. The form reminds the applicator of the required spray buffers for fish-bearing and drinking water streams,

[87] National Council for Air and Stream Improvement, 2013. ~~*Measurement of Glyphosate, Imazapyr, Sulfometuron methyl, and Mmetfulfuron methyl in Needle Branch Streamwater.* Special Report No. 130-1.~~

[88] Peterson, E. ~~EPA.~~ 2011. *Comparative Characterization of Pacific Northwest Forestry Requirements for Aerial Application of Pesticides.* Memorandum to Scott Downey, EPA and David Powers, EPA. ~~Memo to Scott Downey, EPA and David Powers, EPA RE: *Comparative Characterization of Pacific Northwest Forestry Requirements for Aerial Application of Pesticides.* August 30, 2011.~~ August 30, 2011.

[89] Oregon Department of Forestry. 2015. Forest Activity Electronic Reporting and Notification System (FERNS). Available at: https://ferns.odf.state.or.us/E-Notification

[90] Oregon Department of Forestry. 2013. "Daily Chemical Application Record Form." Revised September 2013. Available at: http://www.oregon.gov/odf/privateforests/docs/ChemicalApplicationForm_Final.pdf.

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but does not specify protections for non-fish-bearing streams or voluntary best practices included in the OAR Guidance Manual for Chemicals and Other Petroleum Products (Division 620) that should be followed other than a general sentence that applicators should comply with rules under the Forest Practices Rule and label instructions.

Oregon's broader strategy for cross-program coordination on pesticides includes its Water Quality Pesticide Management Plan, Pesticide Stewardship Program, and Pesticide Analytical and Response Center (PARC). The Water Quality Pesticide Management Plan guides statewide actions to protect waters from pesticide contamination using water quality to drive adaptive management. Oregon's PSP is an ODEQ initiative that works with State and local partners to collect and analyze water samples in areas with the greatest potential for impacts to aquatic life and human health. PARC is a multistate agency group that coordinates investigations to collect and analyze information about reported incidents.

NOAA and EPA acknowledge the progress Oregon has made in establishing a multiagency management team and programs to assess and manage pesticide water quality issues. As these efforts apply to the aerial application of herbicides in the coastal nonpoint management area, however, the federal agencies note that water quality monitoring data on pesticides is still limited in the State and that, while Oregon has established ten PSP monitoring areas in nine watersheds, the State only launched two pilots within the coastal nonpoint management area very recently. While NOAA and EPA recognize that the PSP program targets the most problematic or potentially problematic watersheds and that Oregon received recent funding to expand into two new watersheds, the agencies believe that if monitoring data are to drive adaptive management, the State should develop and maintain more robust and targeted studies of the effectiveness of its pesticide monitoring and best management practices within the coastal nonpoint management area. The federal agencies encourage the State to design its monitoring program in consultation with EPA and NMFS.

NOAA and EPA believe that Oregon could develop additional management measures for forestry that will protect non-fish-bearing streams during the aerial application of herbicides to achieve and maintain water quality standards and protect designated uses through a variety of mechanisms. Some potential approaches could include one or more of the following actions:

- Adopt rules that would require spray buffers for the aerial application of herbicides along non-fish-bearing streams. Oregon may wish to look at spray buffer requirements that neighboring states have established for ideas;
- Adopt riparian buffer protections for timber harvest along non-fish-bearing streams that, by default, would also provide a buffer during aerial spraying;
- Expand existing guidelines for voluntary buffers for the aerial application of herbicides on non-fish-bearing streams;
- Educate and train aerial applicators of herbicides on the new guidance;
- Revise the ODF Notification of Operation form required prior to chemical applications on forestlands to include a check box for aerial applicators to indicate that they must adhere to FIFRA labels for all stream types, including non-fish-bearing streams;

- Track and evaluate the implementation of voluntary measures for the aerial application of herbicides along non-fish-bearing streams to assess the effectiveness of these practices and, if adjustments are needed, to achieve water quality standards and protect designated uses;
- Provide detailed maps of non-fish-bearing streams and other sensitive sites and structures to increase awareness of the areas that need protection among the aerial applicator community; and
- Encourage the use of global positioning system (GPS) technology, linked to maps of non-fish-bearing streams, to automatically shut off nozzles before crossing non-fish-bearing streams.

If Oregon chooses a voluntary approach, the State must also meet the other CZARA requirements for using voluntary, incentive-based programs as part of the State's coastal nonpoint program. This includes a description of the methods the State will use to track and evaluate the voluntary programs, a legal opinion stating it has the necessary backup authority to require implementation of the voluntary measures, a description of the process that links the implementing agency with the enforcement agency, and a commitment to use the existing enforcement authorities, where necessary.

II. CONDITIONS THAT ARE NO LONGER A BASIS FOR THIS DECISION

A. URBAN AREAS MANAGEMENT MEASURES—NEW DEVELOPMENT

PURPOSE OF MANAGEMENT MEASURE: The purpose of this management measure is 4-fold: (1) decrease the erosive potential of increased volumes and velocities of stormwater associated with development-induced changes in hydrology; (2) remove suspended solids and associated pollutants entrained in runoff that result from activities occurring during and after development; (3) retain hydrological conditions that closely resemble those of the predisturbance condition; and (4) preserve natural systems, including in-stream habitat.

CONDITION FROM JANUARY 1998 FINDINGS: Within 2 years, Oregon will include in its program: (1) management measures in conformity with the 6217(g) guidance; and (2) enforceable policies and mechanisms to ensure implementation throughout the coastal nonpoint management area (1998 Findings, section IV.A).

FINDING: Based on information provided in Oregon's March 2014 submission, NOAA and EPA now believe the State has satisfied this condition. The new development management measure is no longer a basis for finding that Oregon has failed to submit an approvable program under CZARA.

RATIONALE NOT INCLUDED: NOAA and EPA will provide a rationale for public comment if/when the federal agencies are in a position to propose full approval of Oregon's coastal nonpoint pollution control program at a later point in time.

B. OPERATING ONSITE SEWAGE DISPOSAL SYSTEMS

PURPOSE OF MANAGEMENT MEASURE: The purpose of this management measure is to minimize pollutant loadings from operating OSDS.

CONDITION FROM JANUARY 1998 FINDINGS: Within 2 years, Oregon will finalize its proposal to inspect operating OSDS, as proposed on page 143 of its program submittal (1998 Findings, section IV.C).

FINDING: Based on information provided in Oregon's March 2014 submission, NOAA and EPA now believe the State has satisfied this condition. The OSDS management measure is no longer a basis for finding that Oregon has failed to submit an approvable program under CZARA.

RATIONALE NOT INCLUDED: NOAA and EPA will provide a rationale for public comment if/when the federal agencies are in a position to propose full approval of Oregon's coastal nonpoint pollution control program at a later point in time.

III. ADDITIONAL COMMENTS

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A. AGRICULTURAL MANAGEMENT MEASURES—EROSION AND SEDIMENT CONTROL, NUTRIENT, PESTICIDE, GRAZING, AND IRRIGATION WATER MANAGEMENT

As noted in the Foreword, the federal agencies invited public comment on the adequacy of the State's programs and policies for meeting the 6217(g) agriculture management measures and conditions placed on Oregon's Coastal Nonpoint Program.

PURPOSE OF MANAGEMENT MEASURES: The purposes of these management measures are to (1) reduce the mass load of sediment reaching a water body and improve water quality and the use of the water resource; (2) minimize edge-of-field delivery of nutrients and minimize leaching of nutrients from the root zone; (3) reduce contamination of surface water and ground water from pesticides; (4) reduce the physical disturbance to sensitive areas and reduce the discharge of sediment, animal waste, nutrients, and chemicals to surface waters; and (5) reduce nonpoint source pollution of surface waters caused by irrigation.

CONDITIONS FROM JANUARY 1998 FINDINGS: Within 1 year, Oregon will (1) designate agricultural water quality management areas (AWQMAs) that encompass agricultural lands within the coastal nonpoint management area, and (2) complete the wording of the alternative management measure for grazing, consistent with the 6217(g) guidance. Agricultural water quality management area plans will include management measures in conformity with the 6217(g) guidance, including written plans and equipment calibration as required practices for the nutrient management measure, and a process for identifying practices that will be used to achieve the pesticide management measure. The State will develop a process to incorporate the irrigation water management measure into the overall AWQMA plans.

Within 5 years, AWQMAPs will be in place (1998 Findings, section II.B).

DISCUSSION: In 2004, the federal agencies provided Oregon with an informal interim approval of its agriculture conditions, believing that the State had satisfied those conditions, largely though its Agriculture Water Quality Management Act (ORS 568.900-933, also known as SB 1010) and nutrient management plans (ORS-468B, OAR-603-074). At that time, the federal agencies found that those programs demonstrated that the State had processes in place to implement the 6217(g) management measures for agriculture as CZARA requires.

Although the federal agencies initially found that those programs enabled the State to satisfy the agriculture condition, prior to announcing the proposed decision, some specific concerns with the State's agriculture program were brought to the federal agencies' attention, such as:

- Enforcement is limited and largely complaint-driven; it is unclear what enforcement actions have been taken in the coastal nonpoint management area and what improvements resulted from those actions.

- The AWQMA plan rules are general and do not include specific requirements for implementing the plan recommendations (e.g., specific buffer requirements to adequately protect water quality and fish habitat).
- AWQMA planning has focused primarily on impaired areas when the focus should be on both protection and restoration.
- The State does not administer a formalized process to track implementation and effectiveness of AWQMA plans.
- AWQMA planning and enforcement does not address "legacy" issues created by agriculture activities that are no longer occurring.

Given these concerns, NOAA and EPA chose to solicit additional public comment on whether the State had satisfied the 6217(g) agriculture management measure requirements and the conditions related to agriculture placed on its program. The federal agencies appreciate the comments provided and are considering them closely. NOAA and EPA will work with the State, as necessary, to ensure it has programs and policies in place to satisfy all CZARA 6217(g) requirements for agriculture before proposing and making a final decision that the State has a fully approved coastal nonpoint program. For a summary of the comments received related to agriculture, see http://coast.noaa.gov/czm/pollutioncontrol/.

IV. LIST OF ACRONYMS AND ABBREVIATIONS

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Acronym or Abbreviation	Definition
AWQMA	Agricultural water quality management area
AWQMAP	Agricultural water quality management area plan
BiOp	Biological opinion
Board	Board of Forestry
CMER	Cooperative Monitoring Evaluation and Research
Coastal Nonpoint Program	Coastal Nonpoint Pollution Control Program
CSRI	Coastal Salmon Restoration Initiative
CZARA	Coastal Zone Act Reauthorization Amendments of 1990
DBH	Diameter at breast height
EPA	Environmental Protection Agency
EQC	Environmental Quality Commission
ESA	Endangered Species Act

Acronym or Abbreviation	Definition
Federal agencies	National Oceanic and Atmospheric Administration and the U.S. Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FPA	Forest Practices Act
GIS	Geographic information system
GPS	Global Positioning System
ICS	Interagency Coordinating Subgroup
IMST	Independent Multidisciplinary Science Team
kPa	kiloPascal
NCASI	National Council for Air and Stream Improvement
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OAR	Oregon Administrative Rules
ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
OPSW	Oregon Plan for Salmon and Watersheds
Oregon Plan	Oregon Plan for Salmon and Watersheds
OSDS	Onsite sewage disposal systems
PARC	Pesticide Analytical and Response Center
PCW	Protection of Cold Water
PSP	Pesticide Stewardship Partnership
RipStream	Riparian and Stream Temperature Effectiveness Monitoring Program
State	State of Oregon

Acronym or Abbreviation	Definition
TMDL	Total Maximum Daily Load
U.S.	United States
USGS	U.S. Geological Survey