OREGON COASTAL NONPOINT PROGRAM
NOAA/EPA FINAL FINDING

FOREWORD

This document contains the bases for the final determination by the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Environmental Protection Agency (EPA) (collectively, the federal agencies) that the State of Oregon (State) has failed to submit an 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 the federal agencies find that the State has not fully satisfied all conditions placed on the State's Coastal Nonpoint Program.

On January 13, 1998, the federal agencies approved the Oregon Coastal Nonpoint Program subject to specific conditions that the State still needed to address (see "Oregon Conditional Approval Findings"). Since then, the State has made incremental modifications to its program and has 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 relating to these conditions, as well as the extent to which those findings support a finding that the State failed to submit an approvable program under CZARA.

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. Comments were request based on concerns the federal agencies had heard about agriculture nonpoint source management in the state and the National Marine Fisheries Services (NMFS) citing of insufficient riparian buffers around agriculture activities as a contributing factor to coho salmon decline, ~~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's notice of intent did not propose a specific decision on whether or not 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 currently a basis for these ~~final~~ findings that Oregon has failed to submit an approvable coastal nonpoint program. The public will have an opportunity to comment on NOAA and EPA's proposed decision regarding the agriculture management measures at a later date. (See "NOAA and EPA Response to Comments Regarding the Agencies' Proposed Finding that Oregon has Failed to Submit a Fully Approvable Coastal Nonpoint Program" for a summary of the comments received and NOAA and EPA's response to them.)

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").

NOAA and EPA have carefully reviewed the public comments received and the State's March 2014 submission and have made a final determination that Oregon has failed to submit an approvable coastal nonpoint program. This decision is based on the State's failure to 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 these conditions are no longer a basis for the finding that Oregon has failed to submit an approvable coastal nonpoint program. NOAA and EPA's decision on the adequacy of the State's programs and policies for meeting the CZARA 6217(g) agriculture management measures will be made at a later date.

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

- *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 the federal agencies' final finding regarding the additional management measures for forestry condition. This finding forms the basis for the federal agencies' proposed determination that the State has failed to submit an approvable program. 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 measures and conditions placed on Oregon's Coastal Nonpoint Program.

NOAA and EPA's final 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. If, based on a later review of information received from the State subsequent to what the federal agencies considered for this document, NOAA and EPA determine that the State has submitted a fully approvable program, the federal agencies will provide another opportunity for public comment. At this time, the public will be asked to provide comment on whether or not the State has satisfied all conditions placed on its program in 1998 and met all CZARA requirements.

PROPOSED FINDING OF FAILURE TO SUBMIT AN APPROVABLE PROGRAM

The federal agencies find that the State of Oregon has failed to submit an 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 satisfying the additional management measures for forestry, Oregon has failed to submit an approvable program under CZARA.

RATIONALE: Oregon proposes to address the additional management measures for forestry condition through a combination of regulatory and voluntary programs. While Oregon has made some progress towards meeting this condition, the State has not identified or begun to apply additional management measures to 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 demonstrated it has management measures, backed by enforceable authorities, in place to: (1) protect riparian areas for medium and small fish bearing streams, and non-fish bearing (type "N") streams; (2) protect high-risk landslide areas; (3) address the impacts of forest roads, particularly on so-called "legacy" roads; and (4) ensure adequate stream buffers for the application of herbicides, particularly on non-fish bearing streams.

Protection of Riparian Areas: Protection of Riparian Areas: Oregon relies on both regulatory and voluntary measures to provide riparian protections for medium and small fish bearing

streams (type "F" streams) and non-fish bearing streams (type "N" streams). Generally, under the current Forest Practices Act (FPA) rules, no tree harvesting is allowed on private lands within 20 feet of fish bearing streams, or medium 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 fish bearing streams (from the stream edge out to50 or 70 feet, respectively). In addition, the FPA rules establish basal area targets for some riparian management areas. For example, along medium fish bearing streams, there is a requirement to leave 30 trees (at least 8 inches DBH) per 1000 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 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 streams the same as fish streams for buffer retentions.[1]

However, based on the results of a number of studies including those summarized below, NOAA and EPA find that additional management measures (beyond those in FPA rules and the voluntary program), for forestry riparian protection around medium 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, per the condition on the federal agencies earlier approval of Oregon's coastal nonpoint program under CZARA, Oregon must still adopt additional management measures applicable to the forestry land use and forested areas in order to protect small and medium fish bearing streams and non-fish bearing streams from pollution attributable to forestry practices in riparian areas.

A significant body of science, including: 1) the Oregon Department of Forestry's (ODF) Riparian and Stream Temperature Effectiveness Monitoring Project (RipStream)[2]; 2) "The Statewide Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality" (i.e., the "Sufficiency Analysis")[3]; and 3) the Governor's Independent Multidisciplinary Science Team (IMST) Report on the adequacy of the Oregon forest practices in recovering salmon and trout[4], indicates that riparian protection around small and medium fish bearing streams and non-fish bearing streams in Oregon is not sufficient to protect water quality and beneficial uses.

---

[1] 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

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

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. 2011. 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. 2011. Response of western Oregon stream temperatures to contemporary forest management. Forest Ecology and Management, doi:10.1016/j.foreco.2011.07.012

[3] 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.

[4] 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, Oregon.

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.[5]" The IMST team made the following recommendations: 1) because non-game 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 from fish-bearing streams when determining the buffer width protections[6]; 2) there should be an increase in the basal area and requirements for riparian management areas for both small and medium 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 streams. [7]

The 2002 Sufficiency Analysis found that the Oregon FPA's prescribed riparian buffer widths for small and medium fish bearing streams may be inadequate to prevent temperature impacts. That analysis concluded: 1) FPA Standards for some medium and small Type F streams in western Oregon may result in shortterm 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. [8]

The 2011 RipStream reports found that FPA riparian protections on private forest lands did not ensure achievement of the Protection of Cold Water criterion (PCW) under the Oregon water quality standard for temperature.[9] [10]The PCW criterion prohibits human activities, such as timber harvest, from increasing stream temperatures by more than 0.3ºC at locations critical to salmon, steelhead or bull trout. The RipStream analysis found that the chance of a site managed using FPA rules exceeding the PCW criterion between a pre-harvest year and a post-harvest year was 40%.[11] .[12]

The RipStream study also found 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 measures found on state forest land) are more likely to maintain stream temperatures similar to control conditions. [13]

In 2013, the EPA, together with the USGS and the BLM, sought to summarize pertinent scientific theory and empirical studies to address the effects of riparian management strategies on

---

[5] Independent Multidisciplinary Science Team. 2.
[6] Ibid. 21 and 43.
[7] Ibid. 44-45.
[8] Oregon Department of Forestry and Oregon Department of Environmental Quality. 44-45.
[9] 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, vol. 47, W01501, 12 pp., 2011.
[10] Groom, J.D., 2011. "Update on Private Forests Riparian Function and Stream Temperature (RipStream) Project". Staff Report; November 3, 2011.
[11] Ibid. 2.
[12] 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, vol. 47, W01501, 2 pp., 2011.
[13] Ibid.2. 3.

stream function, with a focus on temperature[14]. With regard to no-cut buffers adjacent to clearcut harvest units, that paper noted that substantial effects on shade have been observed with "no-cut" buffers ranging from 20 to 30 meters[15], and small effects have been observed in studies that examined "no-cut" buffer widths of 46 meters wide[16]. 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[17]. The paper also found that at "no-cut" buffer widths of less than 20 meters, there were pronounced reductions in shade and increases in temperature, as compared to wider buffer widths. The most dramatic effects were observed at the narrowest buffer widths (less than or equal to 10 meters).[18] As noted above, existing FPA buffers for small and medium fish require only 20 foot (~7 meter) "no-cut" buffers within a riparian management zone of ~17 to ~23 meters, and no vegetation retention is required on small non-fish streams in the Coast Range and Western Cascades.

Oregon also has been investing in three paired watershed studies.[19] These studies are designed to analyze the effects of timber harvesting on a watershed and reach scale. Several commenters have cited the paired watershed study as evidence that the current FPA practices for riparian protection are effective at achieving water quality standards and protecting designated uses. Unpublished preliminary data from the Hinkle Creek study indicate that changes in stream temperature after timber harvesting along non-fish bearing streams were variable. In addition, there was no measureable downstream effect on temperatures.[20] However, the variation in stream temperature and overall net observed temperature decrease may be attributable to increased slash debris along the stream after harvest, as well as a likely increase in stream flow post-harvest that could prevent an increase in temperatures and contribute to lower mean stream temperatures.[21] Therefore, there may be other factors at play that make it difficult to draw any definitive conclusions about the adequacy of the FPA practices from theHinkle Creek results. 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.[22]

NOAA and EPA acknowledge that Oregon is working to address some of the inadequate riparian protection measures in the FPA. The Oregon Board of Forestry (Board) has the authority to regulate forest practices through administrative rule making and could require changes to the FPA rules to protect small and medium fish bearing streams. The Board, recognizing the need to better protect small and medium fish bearing streams, directed ODF to undertake a rule analysis process that could lead to revised riparian protection rules. At its September 2014 meeting, the

---

[14] Leinenbach, P., McFadden, G., and C. Torgersen. 2013. Effects of Riparian Management Strategies on Stream Temperature. Prepared for the Interagency Coordinating Subgroup (ICS). 22 pages. Available upon request.
[15] Brosofske et al. 1997, Kiffney et al. 2003, Groom et al. 2011b as cited in Leinenbach et al. 2013.
[16] Science Team Review 2008, Groom et al. 2011a as cited in Leinenbach et al. 2013.
[17] Anderson et al. 2007, Science Team Review 2008, Groom et al. 2011a, Groom et al. 2011b as cited in Leinenbach et al. 2013
[18] 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.
[19] http://watershedsresearch.org/watershed-studies/
[20] Watersheds Research Cooperative 2008. Hinkle Creek Paired Watershed Study. http://oregonforests.org/sites/default/files/publications/pdf/WRC_Hinkle.pdf
[21] Kibler, K.M. 2007. The Influence of Contemporary Forest Harvesting on Summer Stream Temperatures in Headwater Streams of Hinkle Creek, Oregon. Thesis for the degree of Master of Science in Forest Engineering presented on June 28, 2007. Oregon State University. http://watershedsresearch.org/assets/reports/WRC_Kibler,Kelly_2007_Thesis.pdf
[22] Seeds, J., Mitchie, R., Foster, E., ODEQ, Jepsen, D. 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. 06/19/2014

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 and small fish bearing streams on private forest lands. NOAA and EPA encourage the State to move forward with this rule making process expeditiously. Until more protective FPA rule changes are adopted, the federal agencies would not consider them as part of the State's coastal nonpoint program.

NOAA and EPA also remain concerned that the Board and ODF are not proposing increased protection for riparian areas around non-fish bearing streams. As previously discussed in the IMST study, non-fish bearing streams should be treated no differently from fish-bearing streams when determining buffer-width protection[23] Oregon should identify and adopt additional management measures necessary to protect small non-fish bearing streams to ensure attainment of water quality standards and designated uses.

Forestry Road Additional Management Measures: In the 1998 conditional approval findings, NOAA and EPA called out specific concerns with the ability of Oregon's existing FPA rules to adequately address road density and maintenance, particularly on so-called "legacy" roads, to attain water quality standards and protect designated uses. In the rationale, NOAA and EPA 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, this has resulted in significantly altered surface drainage, diversion of water from natural channels, and serious erosion or landslides."

Oregon has established both regulatory and voluntary measures to address road- associated pollutant impacts to water quality, and has suggested that further additional management measures for roads are not necessary at this time. While NOAA and EPA acknowledge the progress the State has made, as discussed further below, the federal agencies maintain that additional work is needed to ensure the State has adequate additional management measures in place for forestry roads, including legacy roads.

Since 1998, the Board of Forestry has made several improvements to general road maintenance measures to improve water quality. Changes made in 2002 and 2003, included: (1) establishment of a "Critical Locations" Policy for avoiding the building of roads in critical locations such as high hazards landslide areas, steep slopes, or within 50 feet of waterbodies; (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). These improvements will help reduce sedimentation from roadways. However, the new drainage requirements are triggered only when new road construction or re-construction of existing roads occurs. The rule changes and new policies do not sufficiently address water quality problems associated with "legacy roads" (e.g., roads that do not meet current state requirements with respect to siting, construction, maintenance, and road drainage) or problems associated with a large portion of the existing road network where construction or reconstruction is not proposed.

[23] Independent Multidisciplinary Science Team. 1999.

Oregon proposed to address these 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, the State described ODF's voluntary Road Hazard and Identification and Risk Reduction Project where private and state forestland owners survey their road networks to identify roads that pose risks to salmonid habitat and prioritize roads for remediation. Although Oregon reports that thousands of road miles have been inspected and repaired across the state since the inception of this program in 1997, the State did not indicate the impact the program has had within the coastal nonpoint program management area or how many of these projects addressed active forest roads and roads retired according to current FPA practices versus problems associated with older, legacy roads.

Oregon also noted it has entered into a cooperative agreement with the USDA 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 survey and GIS layer will consider legacy roads or how the state will use to 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 things. While NOAA and EPA encourage the State to continue to conduct this and other audits to assess compliance with FPA rules, as noted earlier, legacy roads are not subject to FPA rules. Issues resulting from legacy roads and general road maintenance issues where construction or reconstruction is not occurring that would trigger compliance would the FPA would not be observed during this audit.

NOAA and EPA recognize that legacy roads are being addressed through voluntary measures, and that legacy roads have been the target of significant landowner investment. However, as noted in the Oregon Coastal Coho Assessment,[24] old roads make up the majority of forest roads, and road inventory data on private land is not widely available. As such, 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.

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 back-up enforcement authority for the voluntary measures and commit to exercising the back-up authority when necessary. While the State has provided the federal agencies with a legal opinion detailing the suitability of its back-up authorities, the State has not provided (either in writing or through past practice) a commitment to exercise its back-up

[24] 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.

authority to require implementation of the additional management measures for forestry roads, as needed. Also, the State has not described specifically how these voluntary efforts have and will continue to address legacy road issues within the coastal nonpoint management area. Nor has the State fully described how it continues to monitor and track the implementation of these measures to address forestry road issues, including legacy roads (not just through one-time compliance audits but through more routine monitoring practices).

Legacy roads remain an issue 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. These roads would often parallel low gradient streams (historically the most productive coho habitat) and cross many tributaries.[25] Prior to modern best management practices, mid-slope roads would often be connected to these valley bottom roads to access harvest units.[26] It is widely recognized that these poorly designed forest roads increase sediment supplied to streams by altering hillslope hydrology, surface runoff, and sediment flux.[27,28,29,30,31] These roads can also become a chronic source of low level sediment over time.[32] The ecological consequences of sediment chronically supplied from roads may be equally or even more detrimental over time than periodic sediment pulses.[33] Furthermore, legacy roads can serve as initiation points for landslides many years (or even decades) after construction.[34] For example, one study found that forestry roads in Oregon built before 1984, have higher landslide rates than those built later.[35]

While ODF's 2002 Sufficiency Analysis found that, except for wet weather road use which the Board has since addressed (see above), complying with the current FPA road best management practices is likely to meet water quality standards, the analysis did not examine the impacts of legacy roads which do not adhere to current forest practices. Oregon's Independent Multidisciplinary Science Team (IMST) did find that:

---

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

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

[27] Reid, L. M., Dunne, T., 1984. Sediment production from forest road surfaces. Water Resources Research 20(11), 1753-1761.

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

[29] 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

[30] 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.

[31] 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.

[32] 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.

[33] 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.

[34] 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.

[35] 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, p. 33, Sessions, 1987.

> "'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."[36]

As part of the development process for the Coastal Salmon Restoration Initiative (CSRI) report, which later evolved in to the Oregon Plan for Salmon and Watershed (Oregon Plan), a 1996 National Marine Fisheries Service (NMFS) memo providing the service's scientific analysis of the draft CSRI report identifies the report's omission of forestry road-related problems as a serious inadequacy. 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.[37]

In addition to water quality impacts, sedimentation and erosion from forestry roads have adverse impacts on salmon. For example, logging roads are a source of fine sediments which enter spawning gravel and can lower the success of spawning and recruitment for coho salmon.[38] NOAA National Marine Fisheries Services' scientific analysis for their Endangered Species Act 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."[39]

Despite the improvements the State has made in addressing forestry roads, NOAA and EPA remain concerned that many forest road networks in Oregon continue to deliver sediment into streams. Oregon notes that some legacy roads may have filled in with trees and other vegetation since being retired from active use and that accessing some of these roads to repair them properly may create more disturbance and potential water quality impacts. While this statement may be accurate in some cases, the State did not provide legacy roads inventory data of the coastal area to support its position. An inventory of all legacy roads and old roads (roads built prior to the 1983 rule changes[40]) would identify the location of the legacy roads, identify where impairments are needed and provide information on effectiveness of any improvements made via its voluntary roads improvement program.

---

[36] 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, Oregon. pp. 47

[37] 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.

[38] 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.

[39] 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 http://www.nwfsc.noaa.gov/assets/25/1916_08132012_121939_SROregonCohoTM118WebFinal.pdf

[40] AD HOC Forest Practices Advisory Committee on Salmon and Watersheds. 2000. Report of the AD HOC Forest Practices Advisory Committee on Salmon and Watersheds to the Oregon Board of Forestry, August 2000. Section B-Forestry Roads, p. B-17.

The suite of voluntary programs Oregon has described may enable the State satisfy the forestry roads element of this condition. However, as discussed above, additional information is needed at this time. The federal agencies encourage the State to provide a commitment to use its back-up authority to ensure implementation of the forestry road additional management measures, when needed and 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 these voluntary measures to carry out identified priority forest road improvements. To support an approvable coastal nonpoint program, the program should 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 on a reasonable timeframe.

Landslide Prone Areas: In the 1998 findings, NOAA and EPA placed a condition on Oregon's program requiring the state to identify and begin applying additional management measures where water quality impairments and degradation of beneficial uses attributable to forestry exist despite implementation of the CZARA 6217(g) measures. The federal agencies identified areas where existing practices under the FPA and FPA rules should be strengthened to attain water quality standards and fully support beneficial uses, among them was the need to provide better protection of areas at high risk for landslides.

Oregon proposes to address the landslide element of the additional management measures for forestry condition through a mix of regulatory and voluntary approaches. While the state has adopted more protective forestry rules to reduce landslide risks to life and property and promotes some voluntary practices to reduce landslide risks through the Oregon Plan for Salmon and Watersheds (The Oregon Plan), Oregon still does not have additional management measures for forestry in place to protect high-risk landslide areas to ensure that water quality standards and designated uses are achieved.

Since receiving conditional approval on January 13, 1998, Oregon 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 these designated high-risk landslide areas for public safety (OAR 629-623-0000 through 629-623-0800). However, under these amendments, shallow, rapidly moving landslide hazards directly related to forest practices are addressed only as they relate to risks for losses of life and property, not for potential water quality impacts. Oregon still allows timber harvest and the construction of forest roads, where alternatives are not available, on high-risk landslide hazard areas as long as it is not deemed a public safety risk.

In addition to these 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 as a suitable management measure to reduce high-risk landslides that have the potential to impact water quality.

Also, Oregon has yet to provide all information needed to use voluntary programs to address this aspect of its coastal nonpoint program. To use 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 back-up authority to ensure implementation of the management measure, and provide a commitment to use that back-up 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 clear cutting compared to unmanaged forests in the Pacific Northwest. For example, Robinson et al. found that in three out of four areas studied in very steep terrain, landslide densities and erosion volumes were greater in stands that were clear-cut during the previous nine years.[41] Landslide rates in Mettman Ridge in the Oregon Coast Range increased after clear cutting at a rate of three to nine times the background rate for the region. The regional analysis from the Mettman Ridge study found that forest clearing dramatically accelerates shallow landsliding in steep terrain typical of the Pacific Northwest.[42] In southwestern Washington, rain fall intensity, slope steepness, and stand age affected landslide rates. [43] Very few landslides occurred when rainfall was less than or equal to a 100-year rainfall event and at higher rainfall intensities, steep slopes had significantly higher landslide densities compared to lower gradient slopes. In addition, they found that at higher rainfall intensities, the density of landslides in recently harvested sites was roughly two to three times the landslide density in older stands.

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.[44] Schmidt et al. noted that median lateral root cohesion is less for industrial forests with significant understory and deciduous vegetation (6.8–23.2 kPa) compared to natural forests dominated by conifers (25.6–94.3 kPa). Additionally, in clearcuts, Schmidt et al. found also that lateral root cohesion is uniformly less than or equal to 10 kPa, making these areas much more susceptible to landslides.

---

[41] Robison, G.R., Mills, K.A., Paul, J. Dent, L. and A. Skaugset. 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.
[42] Montgomery, D. R., K. M. Schmidt, H. M. Greenberg & W. E. Dietrich. 2000. Forest clearing and regional landsliding. Geology 28: 311-314.
[43] Turner, T.R., Duke, S.D., Fransen, B.R., Reiter, M.L., Kroll, A.J., Ward, J.W., Bach, J.L., 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.
[44] Schmidt, K.M., Roering, J.J., Stock, J.D., Dietrich, W.E., Montgomery, D.R., and 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

Sakals and Sidle modeled the effect of different harvest methodologies on root cohesion over time.[45] They found that, of the methodologies examined (clear cutting, single tree selection cutting and strip cutting), clear cutting produces the greatest decline in root cohesion. Further, they found that root cohesion may continue to decline for 30 years post-harvest. 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 clear cutting on hazard 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 landslide.

Not only has the science demonstrated that timber harvesting can contribute to landslides but that these landslides also degrade water quality and impair designated uses in Pacific Northwest streams. Whittaker and McShane cited that:

> "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; Montogomery, 2004)."[46]

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.[47] Within the 91 square mile study area, a total of 1147 landslides were found within harvest units that delivered to public resources (mostly streams). The majority (82%) occurred on hillslopes and the rest initiated from roads. In examining these landslides, the study found that unstable hillslopes logged with no buffer had a significantly (65%) higher landslide density than did mature stands. Unstable slopes logged with no buffer also delivered 347% more sediment than slopes with unlogged, mature stands. The authors conclude that buffers on unstable slopes likely reduce landslide density and sediment volume. This has important implications for water quality and beneficial uses. It is well documented that sediment can 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 waterbodies, creating issues for domestic water supply and public water

[45] 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.

[46] Whittaker, K.A., 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.

[47] Stewart, G., Dieu, J., Phillips, J., O'Connor, M., 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.

providers.[48,49,50,51,52,53]

The science shows clear-cutting increases the rate of landslides and that landslides can adversely affect water quality and beneficial uses. Additional management measures are needed to provide greater protection of landslide prone areas for the protection of water quality in Oregon. To meet this additional management measure requirement, the state needs to establish a suite of measures that collectively address this issue. Examples of measures include but are not limited to the following:

- Adopt harvest and road construction restrictions similar to those applicable in areas where landslides pose risks to life and property, but for all high-risk landslide prone areas with the 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. Such a 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, such as 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 such a manner that the risk of triggering slope failures is minimized. 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 these 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. In particular, look for ways to reduce the occurrence of channelized landslides.

---

[48] Whittaker, K.A., 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.
[49] 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
[50] 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 Washington, USA
[51] EPA. 2003. "Developing Water Quality Criteria for Suspended and Bedded Sediments (SABS): Potential Approaches (Draft). U.S. Environmental Protection Agency, August 2003.
[52] 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.
[53] Oregon Department of Environmental Quality, Turbidity Standards, Background Information. http://www.deq.state.or.us/wq/standards/turbidity.htm

- Integrate processes to identify high-risk landslide prone areas and specific best management practices to protect these areas into the TMDL development process. For example, in the Mid-Coast Basin, DEQ is currently developing a sediment TMDL to address water quality limited waters for biocriteria, 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.[54] As part of the TMDL DEQ would be completing a source assessment of the landslides in relationship to the water quality impairments. NOAA and EPA encourage the state to complete this TMDL and include specific practices that landowners will need to follow in order to reduce pollutants causing impairments addressed in the TMDL.

If the Oregon plans to rely on voluntary efforts, the state would need to describe the full suite of voluntary practices it plans to use address this management measure, how the state would promote these voluntary practices, and meet the other requirements when using voluntary programs to meet 6217(g) management measure requirements (i.e., a legal opinion asserting the state has back-up authority to ensure implementation of the management measure, a commitment to use the back-up authority, and a description of the monitoring and tracking program the state will use to assess how it will monitor and track implementation of the voluntary approach).

Buffers for Pesticide Application on Non-Fish Bearing (Type N) Streams: The federal agencies' January 13, 1998, conditional approval findings noted that Oregon had published forest practices rules that require buffer zones for most pesticide applications (OAR 629-620-0400(7)(b)). However, these rule changes did not address aerial application of herbicides along non-fish bearing streams. NOAA and EPA determined that stream spray buffers for the aerial application of herbicides on non-fish bearing streams on forestlands were inadequate and should be strengthened to attain water quality standards and fully support beneficial uses.

Since its 1998 conditional approval findings, Oregon has provided several documents describing the programs it relies on 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), best management practices set by the 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[55] and Pesticide Stewardship Partnership. 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. Given the lack of monitoring for aerial application of herbicides on non-fish bearing streams in Oregon's coastal forestlands and the potential for adverse water quality and designated use impacts from the aerial application of herbicides, NOAA and EPA continue to believe that Oregon should take additional steps to ensure non-fish bearing streams are adequately protected during the aerial application of herbicides. Aerial application of herbicides, such as glyphosate, 2,4-D, atrazine,

[54] Burns, W. J., Duplantis, S., Jones, C., 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.

[55] ODA, ODEQ, ODF, and OHA. 2011. *Pesticide Management Plan for Water Quality Protection.*

and others, is a common practice in the forestry industry. Herbicides are sprayed to control weeds on recently harvested parcels to prevent competition with newly planted tree saplings. Within the coastal nonpoint management area, non-fish bearing streams comprise 60 to 70 percent of the total stream length. Oregon does not require riparian buffers during forest harvests along non-fish bearing streams, which might otherwise provide a spray buffer. Furthermore, there are no riparian buffers to filter herbicide-laden runoff before it enters the streams.

In the NOAA National Marine Fisheries Services' (NMFS) biological opinion (BiOp) for several EPA herbicide labels, including 2,4-D, aerial drift was identified as the most likely pathway for these herbicides to enter aquatic habitats.[56] NMFS also noted that runoff was also a likely pathway for 2,4-D. The BiOp states that herbicides can have both direct and indirect effects on water quality and aquatic species, including salmon. One of the common indirect effects occurs because herbicides can reduce the growth and biomass of primary producers (algae and phytoplankton) that form the base of the aquatic food chain. The BiOp notes that a decrease in primary production can have significant effects on consumers that depend on the primary producers for food. These effects are often reported at herbicide concentrations well below concentrations that would have a direct effect on consumers. The BiOp discusses that it is difficult to predict the magnitude and duration these impacts would have on juvenile salmon because the extent of salmonid effects often depend on the interaction with many different parameters, such as availability of alternative food sources, water temperature, and other abiotic factors. NMFS concluded that products containing 2,4-D are likely to jeopardize the existence of all listed salmonids and adversely modify or destroy critical habitat. Products containing diuron were also likely to adversely modify or destroy critical habitat, but not likely to jeopardize listed salmonids.

Research has shown that the aerial application of herbicides may adversely impact water quality and salmon. As discussed in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*[57], the condition for forest chemical management is to "use chemicals when necessary for forest management in accordance with the following to reduce nonpoint source pollution impacts due to the movement of forest chemicals off-site during and after application: (4) Establish and identify buffer areas for surface waters. (This is especially important for aerial applications.)" EPA's 1993 guidance cites studies from various sources on aerial application of herbicides. Norris and Moore (1971)[58], observed the concentration of 2,4-D in streams was one to two orders of magnitude higher in forestry operations without buffers than in areas with buffers. Riekirk and others (1989)[59] found that the greatest risk to water quality from forestry pesticide application was from aerial application and drift, runoff, and erosion.

---

[56] NMFS. 2011. *National Marine Fisheries Service Endangered Species Act Section 7 Consultation Biological Opinion Environmental Protection Agency Registration of Pesticides 2,4-D, Triclopyr BEE, Diuron, Linuron, Captan, and Chlorothalonil.* NOAA National Marine Fisheries Service, June 30, 2011.

[57] EPA, 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.* EPA 840-B-92-002. Environmental Protection Agency, January 1993.

[58] Norris, L.A., and D.G. Moore. 1971. *The Entry and Fate of Forest Chemicals in Streams. In Forest Land and Stream Environment – Symposium Proceedings, ed. J.T. Krygier and J.D. Hall. Oregon State University, Corvallis, Or, pp. 138-158.*

[59] Riekirk. H. 1989. *Forest Fertilizer and Runoff Water Quality.* Soil and Crop Science Society of Florida Proceedings, September 20-22, 1988, Marco Island, FL.

Norris et. al. (1991)[60] compiled information from studies done from 1967-1987 that measured herbicides including 2,4-D, picloram, hexazinone, atrazine, triclopyr, glyphosate, and dalapon.

There have been few peer-reviewed studies that have specifically evaluated the extent and effects of aerial application of herbicides in Oregon's coastal nonpoint management area and none on non-fish bearing streams in Oregon's coastal nonpoint management area. Studies in Oregon have found positive detections of hexazinone and 2,4-D ester in water after aerial application.[61] These levels have been below thresholds of concern determined in the studies for people and aquatic life. ODF's Dent and Robben 2000 Study monitored herbicides and fungicides along Type F (fish-bearing) and Type D (drinking water) streams to assess the effectiveness of the FPA pesticide management practices at protecting water quality during drift application.[62] Of 26 sites sampled 24 hours after application, all herbicides detected were at concentrations of less than 1 ppb, below the minimum exposure thresholds for humans and aquatic life. They concluded that the FPA's practices were effective at protecting water quality for Types F and D streams. However, they note they could not draw any conclusions about the FPA's effectiveness at protecting water quality for non-fish bearing streams during the aerial application of herbicides. In a 2012 USGS study[63] in the McKenzie River of the Clackamas Basin outside the coastal zone management area, 43 out of 175 compounds were detected at least once across 28 sites. The study focused on urban, forestry, and agricultural land uses. Nine pesticides were detected out of 14 samples from the drinking water facility's intake from 2002 to 2010. However, concentrations were low, less than 1 part per billion, and the largest number of pesticide detections were associated with urban stormwater. This study was conducted outside the coastal zone management area.

Non-peer-reviewed studies also did not focus on aerial application of herbicides on non-fish bearing streams in forestlands. The Oregon Health Authority's Exposure Investigation (EI) on the Highway 36 Corridor included herbicide samples in water, food, plants, and people. While herbicides have been detected in blood and urine samples, it is not possible to confirm whether these exposures resulted from the aerial application of pesticides or from another source. Low levels of herbicides applied during aerial applications were found in 10 soil samples, but no herbicides were found in drinking water samples [64]. However, the Study noted that herbicide samples were not collected during the primary time of spraying.

OODF's paired watershed study on the Alsea subbasin also found that while some herbicides were detected, they were not at levels that would pose a significant risk to humans or aquatic life.[65] Following the aerial application of herbicides over a non-fish bearing stream segment that did not have riparian buffers, the researchers measured herbicide concentrations at three locations below the application site: at the fish/non-fish bearing stream interface in the middle of

---

[60] Norris, L.A., H.W. Lorz, and S.V. Gregory. 1991. *Forestry Chemicals.* Influences of Forest and Rangeland Management on Salmonid Fishes and Their habitats. American Fisheries Society Special Publication 19, pp. 207-296.

[62] 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.

[63] Kelly, V.J. and C.W. Anderson, 2012. *Reconnaissance of land-use sources of pesticides in drinking water, McKennzie River, Oregon: USGS Scientific Investigations Report 2012-5091.*

[64] Oregon Health Authority. Undated. Draft Final. *Public Health Assessment Highway 36 Corridor Exposure Investigation.*

[65] 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.

the harvest unit; at the bottom of the harvest unit; and well below the harvest unit. Of the five herbicides that were applied, only glyphosate was detected in any of the samples. An initial pulse of glyphosate, ranging from about 40 to 60 ng/L (ppt), was recorded at the fish/no-fish interface site shortly after spraying but matched concentrations observed at the other two sites (approximately 25 ng/L) after three days. A clear pulse of approximately 115 ng/L (ppt) was recorded at the bottom of the harvest unit during a storm event that occurred eight days after application and another clear pulse of approximately 42 ng/L (ppt) was observed at the interface site during a second storm event ten days after spraying. All glyphosate concentrations recorded throughout the study period were orders of magnitude less than what the literature reported as the lowest observable effect for a variety of aquatic species. However, like the earlier ODF assessment, no samples were taken from a non-fish bearing stream segment that was directly under the application site. The water quality impacts to the non-fish bearing stream segment are unknown although one would expect to find higher concentrations of herbicides.

Oregon asserts it relies on the national best management practices established through the federal FIFRA pesticide labels to protect non-fish bearing streams. Currently, EPA, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the 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 over the next 15 years to make the changes, and it is expected that herbicide labels will not be updated until the end of the 15-year process. This ongoing federal process, however, should not preclude Oregon from making needed state-level improvements to how it manages herbicides in the context of its forestry landscape and sensitive species.

Oregon and other Pacific Northwest states have recognized the need to go beyond the national FIFRA label requirements to protect water quality and aquatic species, including salmon, in their state[66]. Oregon has 60-foot spray buffers for non-biological insecticides and fungicides on non-fish bearing streams (OAR 629-620-400(7)) and 60-foot spray buffers for herbicides on wetlands, fish-bearing and drinking water streams (OAT 629-620-400(4)). Compared to neighboring coastal states and jurisdictions, Oregon has the smallest forestry-specific water resource buffers for herbicides on non-fish bearing streams. 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 has riparian buffers for non-fish bearing streams (**), which implicitly restrict the aerial application of herbicides near the stream.

With a lack of information about the specific impacts of herbicide spraying over non-fish bearing streams in Oregon and the scientific literature that shows a potential for negative effects, Oregon needs to ensure that it is providing adequate protections for non-fish bearing streams associated with the aerial application of herbicides.

---

[66] Peterson, E. EPA. 2011. 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.

Oregon has taken many steps in this direction. ODF requires that all pesticide applicators complete a notification form of potential pesticides that may be applied, the stream segments for pesticide application, the window of time in which application may occur, and a reminder of the spray buffers for fish-bearing and drinking water streams that may apply. While ODF's notification form specifically identifies guidance on spray buffers in the FPA, it is silent on Type N streams, presumably relying on FIFRA regulations. ODF's notification form allows a full list of pesticides that the applicator may use, so it is difficult to determine which pesticide will be and is actually applied. ODF also works with ODA to require pesticide applicators to undergo training and obtain licenses prior to being allowed to spray pesticides. Part of the training includes a review of regulations and requirements for protecting streams during aerial application. To reduce aerial drift, Oregon has guidance that instructs applicators to consider temperature, relative humidity, wind speed, and wind direction. For pesticide monitoring, there is currently no monitoring for aerial application of herbicides on non-fish bearing streams in forestland in the coastal nonpoint management area. However, Oregon plans to increase monitoring pesticides on forestlands in the coastal nonpoint management area. Oregon agencies also regularly coordinate through the

Oregon has taken independent steps to further address pesticide water quality issues. In 2007, key state agencies, including ODA, ODF, ODEQ, and the Oregon Health Authority, worked together to develop an interagency Water Quality Pesticide Management Plan to guide State-wide and watershed-level actions to protect surface and groundwater from potential impacts of pesticides, including herbicides. The plan, approved by EPA Region 10 in 2011, focuses on using water quality monitoring data as the driver for adaptive management actions. The plan describes a continuum of management responses, ranging from voluntary to regulatory actions the state could take to address pesticide issues. If water quality concerns cannot be addressed through the collaborative, interagency-effort, regulatory actions are taken using existing agency authorities.

As outlined in the plan, the State's Pesticide Stewardship Partnership (PSP) Program is the primary mechanism for addressing pesticide water quality issues at the watershed level. Through the partnership, the ODEQ works with State and local partners to collect and analyze water samples and use the data to focus technical assistance and best management practices on streams and pesticides that pose a potential aquatic life or human health impact.

NOAA and EPA acknowledge the progress Oregon has made in its establishment of a multi-agency management team, development of its Water Quality Pesticide Management Plan, and implementation of its PSP Program. However, the federal agencies note that water quality monitoring data on pesticides is still limited in the State, and that Oregon has only established eight PSP monitoring areas in seven watersheds, none of which are within the coastal nonpoint management area. While NOAA and EPA recognize that the PSP program targets the most problematic or potentially problematic watersheds, and 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. Moreover, the federal agencies encourage the State to design its

monitoring program in consultation with EPA and NMFS so that it generates data that are also useful for EPA pesticide registration reviews and NMFS biological opinions that assess the impact of EPA label requirements on listed species.

In addition to a more robust, overall monitoring program for herbicides and other pesticides and to fully address the concerns NOAA and EPA raised in the 1998 conditional approval findings, Oregon may be able to achieve greater protection of non-fish bearing streams during the aerial application of herbicides through regulatory or voluntary approaches. An example of a regulatory approach would be to institute spray buffers for the aerial application of herbicides along non-fish bearing streams similar to neighboring states. Another option would be to institute riparian buffers along non-fish bearing streams, which, by default, would also provide a buffer during the aerial application.

Oregon could also institute voluntary programs, backed by enforceable authorities. These voluntary efforts could build on existing programs. Elements of the voluntary program could include, but is not limited to the following:

- Develop more specific guidelines for voluntary buffers or buffer protections for the aerial application of herbicides on non-fish bearing streams.
- Educate and train aerial applicators of herbicides on the new guidance and how to minimize aerial drift to waterways, including non-fish bearing streams, and surrounding communities;
- Revise the ODF Notification of Operation form required prior to chemical applications on forestlands to include a check box for aerial applicators to indicate they must adhere to FIFRA labels for all stream types, including non-fish bearing streams;
- Track the implementation of voluntary measures for the aerial application of herbicides along non-fish bearing streams and assess the effectiveness of these practices to protect water quality and designated uses;
- Conduct direct compliance monitoring for FIFRA label requirements related to aerial application of herbicides in forestry;
- Provide better maps of non-fish bearing streams and other sensitive sites and structures to increase awareness of these sensitive areas that need protection among the aerial applicator community; and
- Employ 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 would also need to meet the other CZARA requirements for using a voluntary, incentive-based programs as part of the state's coastal nonpoint program. This includes describing the process the state will use to monitor and track implementation of the voluntary practices, providing a legal opinion stating it has the necessary back-up authority to require implementation of the voluntary measures, and demonstrating a commitment to use that back-up authority.

II. <u>CONDITIONS THAT ARE NO LONGER A BASIS FOR THIS DECISION</u>

A. URBAN AREAS MANAGEMENT MEASURES – NEW DEVELOPMENT

PURPOSE OF MANAGEMENT MEASURE: The purpose of this management measure is four-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 pre-disturbance condition; and (4) preserve natural systems including in-stream habitat.

CONDITION FROM JANUARY 1998 FINDINGS: Within two 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 the 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 two 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 the 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 waterbody 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 one 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 (AWQMAPs) 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 AWQMAPs. Within five 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-60374). At that time, the federal agencies found that these programs demonstrated that the State has processes in place to implement the 6217(g) management measures for agriculture as CZARA requires.

Although the federal agencies initially found that these 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, such as 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/.