REPORTING WATERSHED IMPROVEMENT

Based on Statistical Evidence of Watershed-wide Improvement (SP-12 Option 2a)

Tillamook River, Oregon

May 2011

Watershed Identification

a	Organization	Oregon Department of Environmental Quality (ODEQ)
b	Point of Contact	York Johnson Phone: 503-322-2222 E-mail: johnson.york@deq.state.or.us
c	Project Title	Reducing bacterial contamination in the Tillamook River watershed, Oregon

Description of 2002 Baseline Condition

d	Watershed(s)	Two HUC-12 watersheds improved: 171002030301 and 171002030302, Upper and Lower Tillamook River, part of the Tillamook Bay Basin in northwest Oregon.
e	2002 Impairments	Impaired for bacteria (Category 4A—TMDL in place): • 171002030301, LLID:1238043453960, Killam Creek, river mile 0 to 5.8 • 171002030301, LLID:1238085453797, Simmons Creek, river mile 0 to 0.9 • 171002030301, LLID:1238134453569, Mills Creek, river mile 0 to 1.2 • 171002030301 and 171002030302, LLID:1238834454692, Lower Tillamook River, river mile 0 to 18.5 • 171002030302, LLID: 1238283454068, Bewley Creek, river mile 0 to 2
		Impaired for Temperature (Category 4A—TMDL in place): • 171002030301, LLID: 1238038453899, Fawcett Creek, summer, mouth to river mile 6.7 • 171002030302, LLID: 1238834454692, Lower Tillamook River during the summer (Category 4A—TMDL in place) river miles 0 to 13.65
		Impaired for Dissolved Oxygen • 171002030302, LLID: 1238834454692, Lower Tillamook River during part of the year (Sep-May)—on 303(d) list from river mile 6.5 to 18.5 • 171002030302, LLID: 1238283454068, Bewley Creek, during part of the year (Sep-May)—on 303(d) list from river mile 6.5 to 18.5
f	Map (optional)	See Attachment A

Evidence of Watershed Approach

g	Area of Effort	The watershed effort took place within the 572-square-mile Tillamook Bay Watershed in northwest Oregon (HUC 17100203). Five major rivers flow into Tillamook Bay: the Miami, Kilchis, Trask, Wilson and Tillamook rivers. Targeted

		watershed efforts specifically within the Tillamook River watershed (171002030301 and 171002030302) led to significant water quality improvements.
h	Stakeholders Involved and Their Roles	Numerous stakeholders have been involved in cleaning up the Tillamook River and Tillamook Bay watersheds, including landowners, businesses and local, state and federal government agencies (see Attachment B). Some key stakeholders include: • **The Tillamook Bay National Estuary Program** led efforts to develop and implement watershed management plans for the larger Tillamook Bay watershed and its tributaries. TEP also offers riparian restoration programs for landowners, has facilitated purchases of sensitive wetland areas in the basin, and leads numerous watershed-wide education and outreach programs for all ages. • **The Tillamook County Performance Partnership, now known as the Tillamook Estuaries Partnership (TEP),** was formed to track and help implement the Tillamook Bay Comprehensive Conservation and Management Plan. The Partnership is a group of 120 members representing community leaders, state and federal agencies, citizens, industries and municipalities. • **The United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) and local Soil and Water Conservation Districts (SWCDs)** help private landowners and managers implement accepted conservation practices to improve land stewardship. The NRCS and the Farm Service Agency administer Farm Bill Programs for the North Coast Basin through the USDA Service Center in Tillamook. The SWCDs also work with landowners and conduct education and outreach. • **Oregon Department of Agriculture (ODA)** oversees the Confined Animal Feeding Operations (CAFO) permit program, which was developed to assist operators and producers with managing their waste to prevent contamination of groundwater or surface water. Since the early 1980s, CAFOs have been registered to a general Water Pollution Control Facility permit designed to protect water quality, while allowing the operators and producers to remain economically viable. • **Oregon Department of Environmental Quality (ODEQ)** is responsible for protecting Oregon's water quality, maintaining a list of water quality limited streams and developing total maximum daily loads. ODEQ provides Clean Water Act (CWA) section 319 funds to support projects in priority watersheds. • **The U.S. Fish and Wildlife Service** funds projects that protect and restore fisheries and wildlife resources. • **Oregon Department of Fish and Wildlife (ODFW)** works with landowners to balance protection of fish and wildlife with economic, social, and recreational needs. Advises on habitat protection. Offers technical and educational assistance for habitat and restoration projects. Provides plan review for special property tax assessment for wildlife habitat projects.

i	Watershed Plan	Stakeholders have collaborated on numerous watershed plans that identify problems and recommend activities to improve water quality in the Tillamook Bay and/or Tillamook River watersheds. The plans vary according to the focus—some focus on a specific type of problem, goal or watershed—but all build on previous planning efforts. They include: • **Tillamook Bay Comprehensive Conservation and Management Plan** (1999) (see www.tbnep.org/resource-center/tep-reports/ccmp) • **North Coast Agricultural Water Quality Management Area Plan** (2000) (see www.oregon.gov/ODA/NRD/water_agplans.shtml) • **Tillamook Bay Watershed Total Maximum Daily load** (TMDL) for temperature and bacteria (2001) (see www.deq.state.or.us/WQ/tmdls/northcoast.htm) • **Watershed Plan/Environmental Assessment for the Lower Tillamook Bay Watershed** (2001) (not available online) • **Development of an Integrated River Management Strategy for the Tillamook Bay Watershed** (2002) (see http://yosemite.epa.gov/R10/ecocomm.nsf/webpage/Tillamook+Bay+Integrated+River+Management+Strategy) • **Tillamook River Coho Restoration Strategy: Habitat Assessment and Limiting Factors Analysis** (2008) (see http://demeterdesign.net/Final_WITH_SUMMARIES_TLFA_Demeter_Design_TBWC.pdf)
j	Restoration Work	Local groups including TEP and Tillamook SWCD and their federal, state and local partners have spent approximately $1.4 million restoring and protecting the Tillamook River watershed (using Clean Water Act section 319 and other funding sources). From 2001 through 2003, TEP's citizen volunteers collected water samples from twenty-two sites in the Tillamook Bay Watershed as part of a bacteria DNA marker study. Led by Oregon State University (OSU) researchers, the DNA Marker study sought to identify bacteria sources by detecting host-specific genetic marker sequences. The DNA study identified whether bacteria were from a human or a ruminant source. In the Tillamook River Basin, the study showed that the bacteria in the upper Tillamook River came from ruminant sources, while that in the lower Tillamook came from both humans and ruminants. This study helped partners target practices. The partners have installed best management practices (BMPs) and completed other projects to reduce bacteria, sediment and temperatures in the Tillamook River Basin (Figure 1). Since 2002, efforts have included: • 28 projects to remove invasive plants and restore native plants in riparian and other sensitive areas • 5 projects to fence out livestock and restore native vegetation around streams • 2 projects to place large woody debris in streams to improve salmonid habitat

- 2 projects to add tidegates to improve fish habitat and water quality
- 12 culverts replaced or modified to reduce flooding and erosion
- 1 project to add a fish ladder
- 1 project to install flood spillway to reduce flooding on agricultural lands
- 2 roads decommissioned to reduce sedimentation

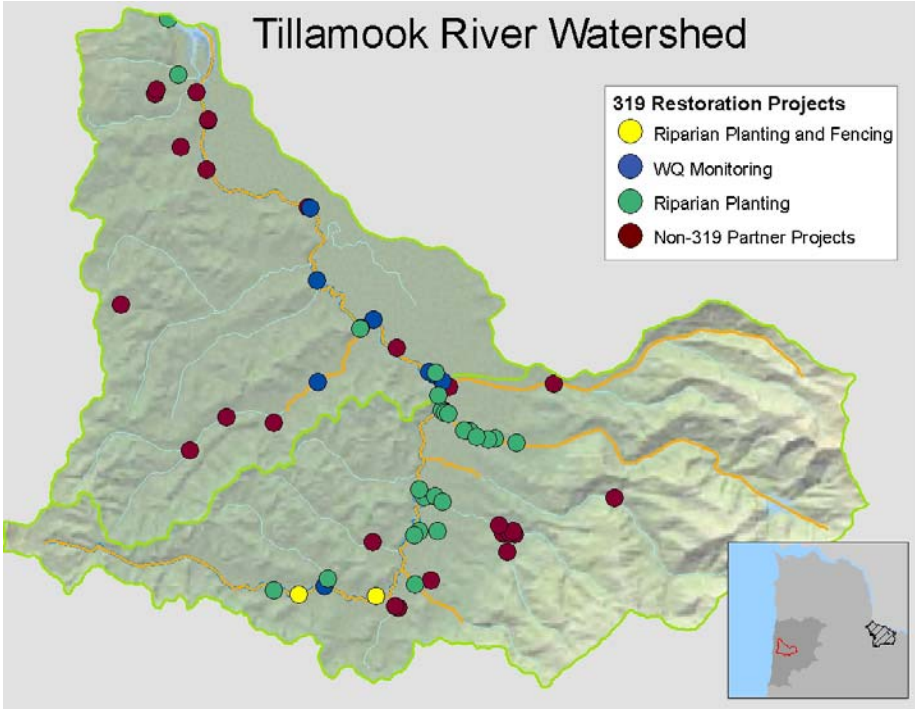

Figure 1. BMPs installed throughout the Tillamook River Basin.

The Tillamook County SWCD conducts numerous educational and outreach activities in the Tillamook River and greater Tillamook Bay watersheds, including distributing fact sheets, holding workshops, and publishing articles in local newspapers.

TEP also conducts numerous education programs, including hosting an annual Children's Clean Water Festival, developing Clean Water Education kits for classroom use, and leading field trips, workshops and classroom-based discussions on water quality and environmental protection.

See Attachment B for more information.

Evidence of Watershed-wide Improvement

k	Impairments Removed (if applicable)	None to date

l	Statistical Results	TEP has collected detailed monitoring data from throughout the Tillamook Bay watershed since 1997, including at 10 stations throughout the lower and upper Tillamook River, extending from the river's mouth to its headwater tributaries. ODEQ performed a Seasonal Kendall trend analysis test on the data from all ten monitoring stations (see Figure A-1 in Attachment A), which are scattered through both the upper and lower Tillamook River sub-basins (HUCs 171002030301 and 171002030302). All but two stations (TL3 and TL13) show with 95 percent or greater confidence level that bacteria counts have decreased since 2003 (Attachment A, Table A-1). Stations TL3 and TL13 (showing no or minor trends) are both on Bewley Creek, a Tillamook River tributary in the upper part of sub-basin 171002030302. All Tillamook River mainstem stations and all monitored tributaries except Bewley Creek show significant declines in bacteria levels. Figures A-3 through A-10 in Attachment A present graphs showing the sites with significantly improving trends. These data have been submitted for upload to LASAR, Oregon's publicly available online water quality database (http://deq12.deq.state.or.us/lasar2).
m	Environmental Significance	The statistical results show that the watershed plans' multi-faceted efforts to reduce bacteria levels are working. Nonpoint source pollution reduction efforts by multiple stakeholders in the Tillamook River watershed included fencing livestock away from the river, improving drainage, restoring riparian areas and restoring wetland areas. By tackling diverse pollution sources through a variety of means, watershed partners have reduced the amount of bacteria reaching the river, which has allowed bacteria levels to drop significantly. Additionally, as the new riparian vegetation matures over time, it should provide long term benefits for seasonal problems with temperature and dissolved oxygen. See Attachments A and B
n	Photos/Graphics (optional)	See Attachment A

Attachment A

Watershed Restoration Reduces Bacteria Levels in Oregon's Tillamook River Basin

SP-12 Submission Option 2a, Supporting Documentation

May 2011

1. Background

The 62-square-mile Tillamook River Basin is one of five major tributaries within the Tillamook Bay Basin in northwest Oregon (Figure A-1). The Tillamook River Basin includes 45 square miles (mi^2) of forest, 13 mi^2 of agriculture and approximately 1.6 mi^2 of both rural residential and rural industrial land uses. The Tillamook River offers habitat for salmon and trout and feeds into shellfish waters. The public uses the Tillamook River for recreational swimming and wading.

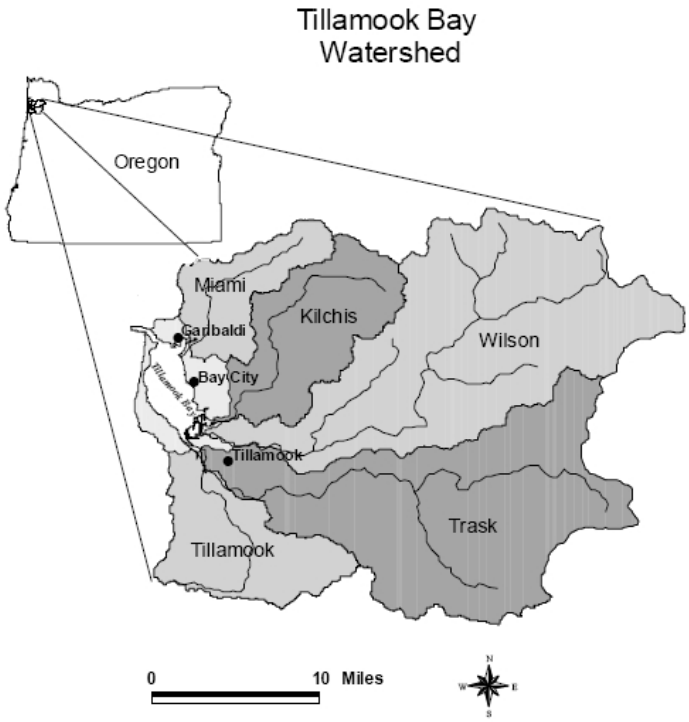

Figure A-1. The Tillamook River Basin is in the southern Tillamook Bay Basin.

2. Pollution Problems and Water Quality Impairments as of 2002

By the mid-1990s, concentrations of bacteria in the waters of the rivers and the Bay were often too high to allow safe shellfishing and recreational use. Sources of bacteria in the watershed included rural and urban residential development (many homes have failing septic systems), urban stormwater runoff, livestock management and other agricultural activities, and several wastewater treatment plants that discharge either to the rivers or the Bay. Oregon Department of Environmental Quality developed a total maximum daily load (TMDL) for the Tillamook Bay Basin in 2001.

In the Tillamook River Basin, the following segments were included on the state's list of impaired waters (listed for bacteria) by 2002 (in Category 4A—TMDL in place):

- HUC 171002030301, LLID: 1238043453960, Killam Creek, river mile 0 to 5.8
- HUC 171002030301, LLID: 1238085453797, Simmons Creek, river mile 0 to 0.9
- HUC 171002030301, LLID: 1238134453569, Mills Creek, river mile 0 to 1.2
- HUC 171002030301 and HUC 171002030302, LLID: 1238834454692, Tillamook River, river mile 0 to 18.5
- HUC 171002030302, LLID: 1238283454068, Bewley Creek, river mile 0 to 2

3. Restoration Levels Led to Declines in Bacteria Levels

TEP has collected detailed monitoring data from throughout the Tillamook Bay watershed since 1997, including at 10 stations (Figure A-2) throughout the lower and upper Tillamook River sub-basins (HUCs 171002030301 and 171002030302). The monitoring network provides a comprehensive look at water quality in the Tillamook River and its tributaries.

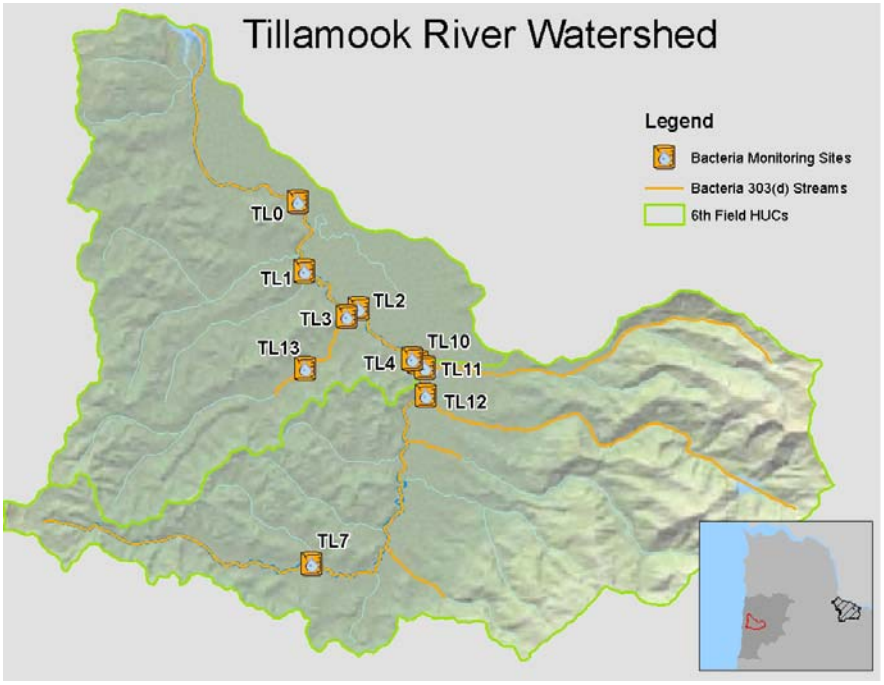

Figure A-2. Monitoring sites in the Tillamook River Basin.

ODEQ performed a Seasonal Kendall trend analysis test on the data from all ten monitoring stations, which are scattered through both the upper and lower Tillamook River sub-basins. All but two stations (TL3 and TL13—both on Bewley Creek in the upper part of sub-basin 171002030302), show with 95 percent or greater confidence level that bacteria counts have decreased since 2003 (Table A-1). The monitoring sites where bacteria levels are declining significantly (with a 95 percent or greater confidence level) are noted visually in Figures A-3 through A-10. The applicable water quality standard for bacteria requires that the 30-day log mean be less than 126 *E. coli* organisms per 100 milliliters (mL) and that no single sample may exceed 406 organisms per 100 mL.

Table A-1. Representative monitoring sites for almost all impaired segments in the watershed show that bacteria levels have dropped significantly.

Impaired Segment	Monitoring Site(s)	Bacteria Declines: Seasonal Kendall Test Confidence Level
Lower Tillamook River sub-basin (171002030302)		
Lower Tillamook River (LLID 1238834454692)	TL0 TL1 TL2	99% 99% 99%
Bewley Creek (LLID 1238283454068)	TL3 TL13	Not significant 80%
Upper Tillamook River sub-basin (171002030301)		
Upper Tillamook River (listing ID 1238834454692)	TL4 TL10 TL7	99% 99% 95%
Killam Creek (LLID 1238043453960)	TL11	99%

Simmons Creek (LLID 1238085453797)	TL10	99%
Mills Creek (LLID 1238134453569)	TL10	99%
Fawcett Creek[1] (LLID 1238038453899)	TL12	99%

[1] Fawcett Creek was first included in the 2004 impaired waters list after TMDL-related monitoring data showed violations of the water quality standard. Results for this site are included here because this waterbody was likely also impaired as of 2002 and data were not available to confirm it at the time.

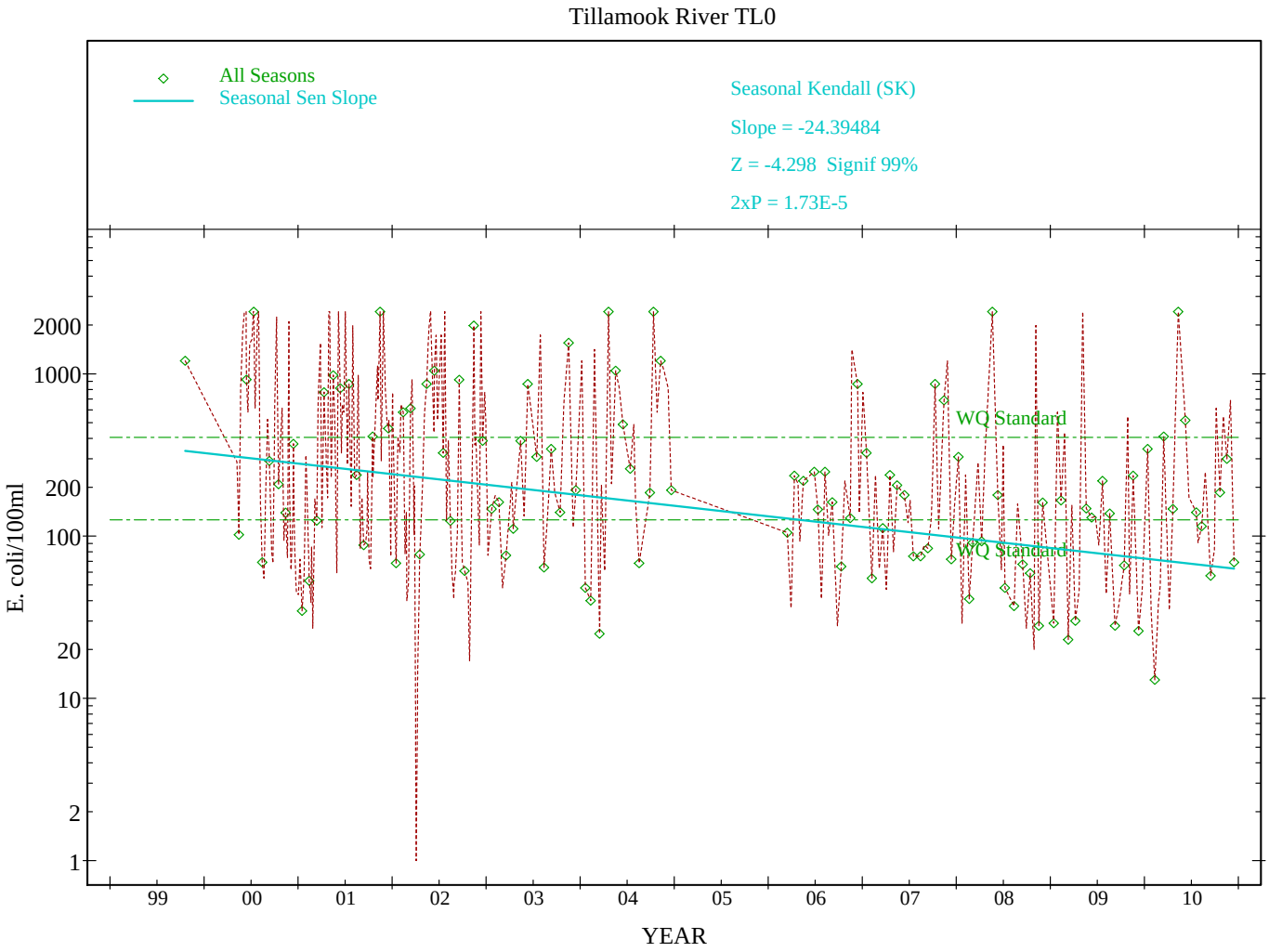

Figure A-3. Seasonal Kendall test results for site TL0 (1999-2010) on the lower Tillamook River mainstem.

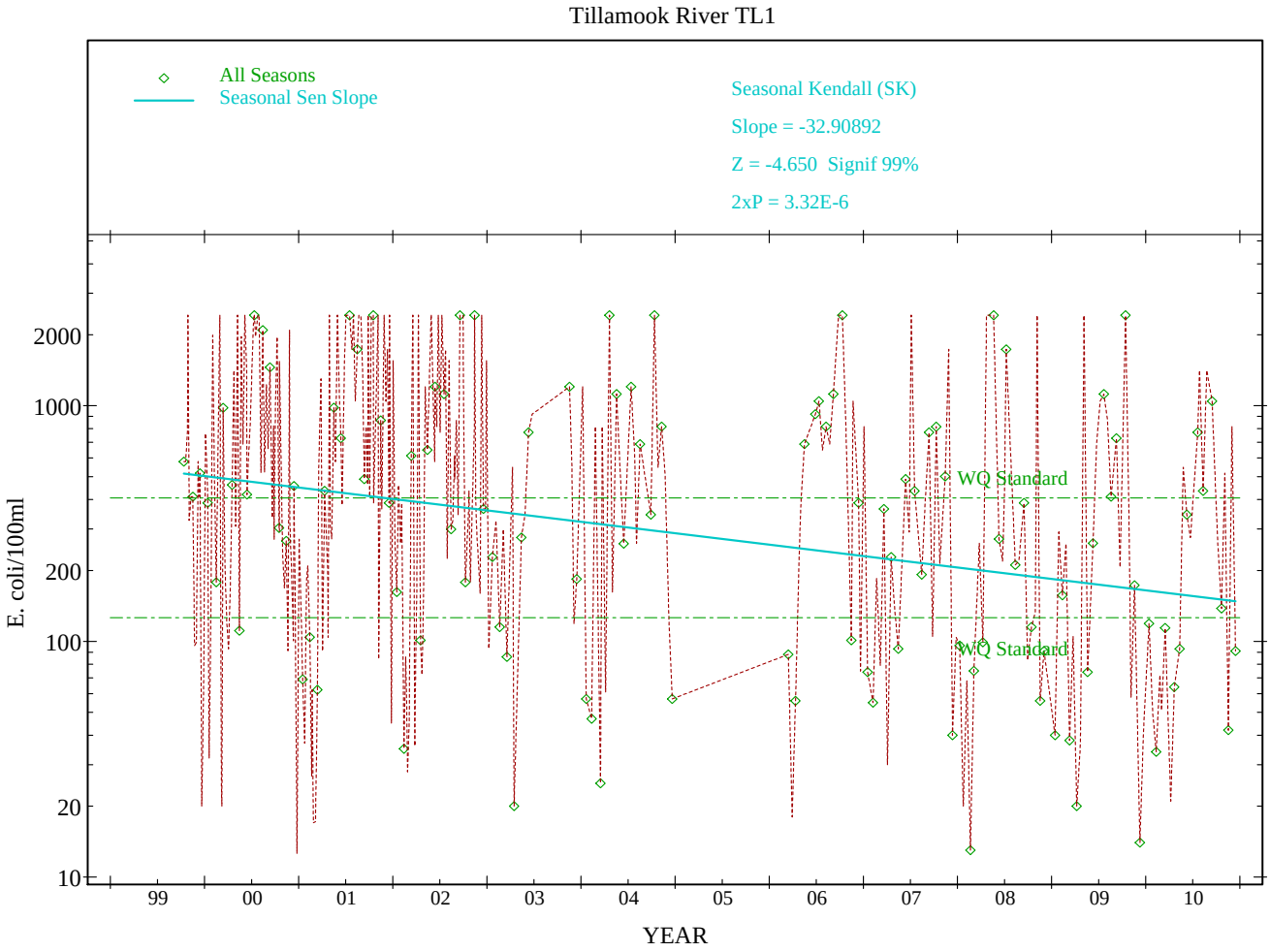

Figure A-4. Seasonal Kendall test results for site TL1 (1999-2010) on the lower Tillamook River mainstem.

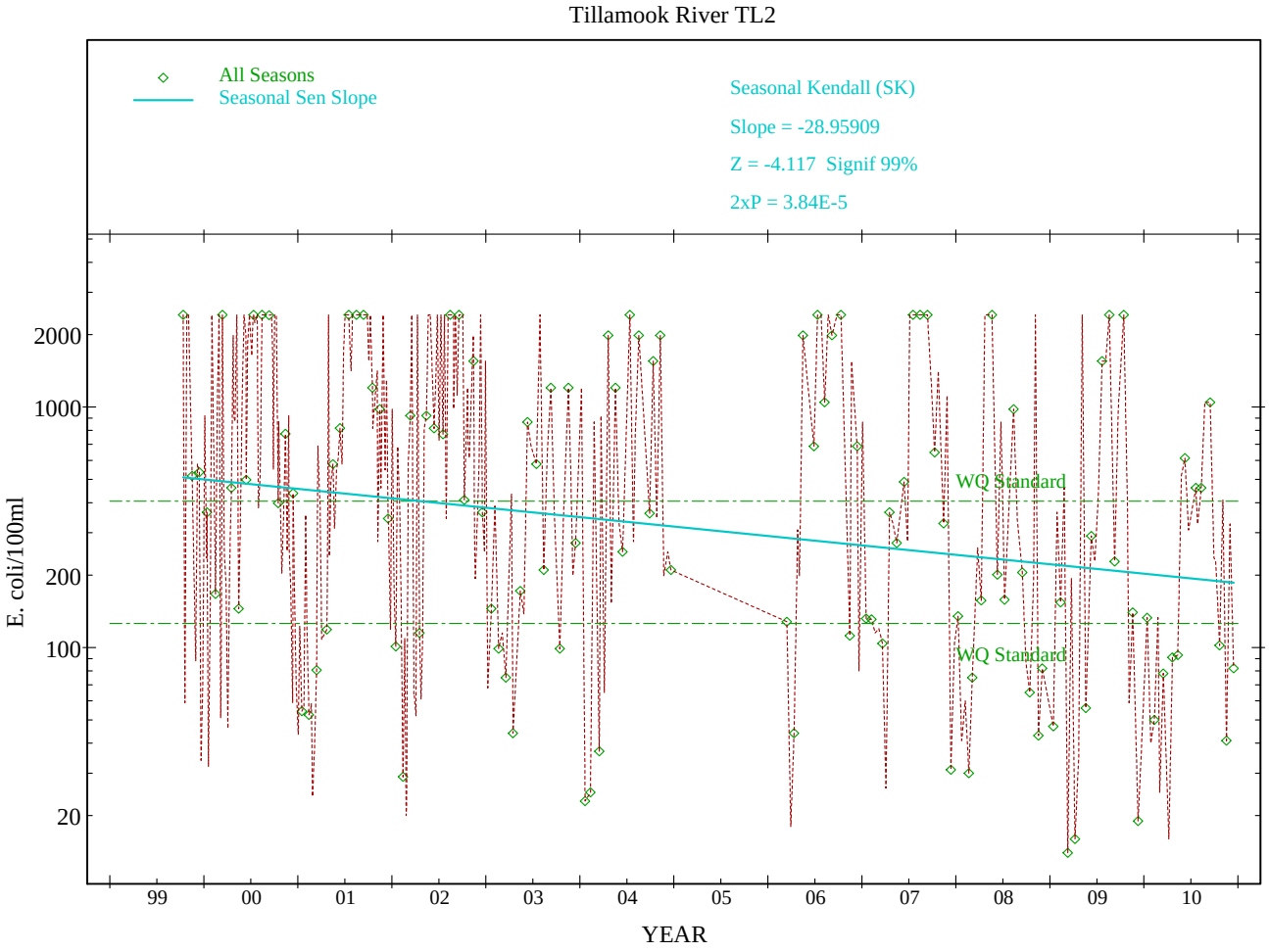

Figure A-5. Seasonal Kendall test results for site TL3 (1999-2010) on the lower Tillamook River mainstem.

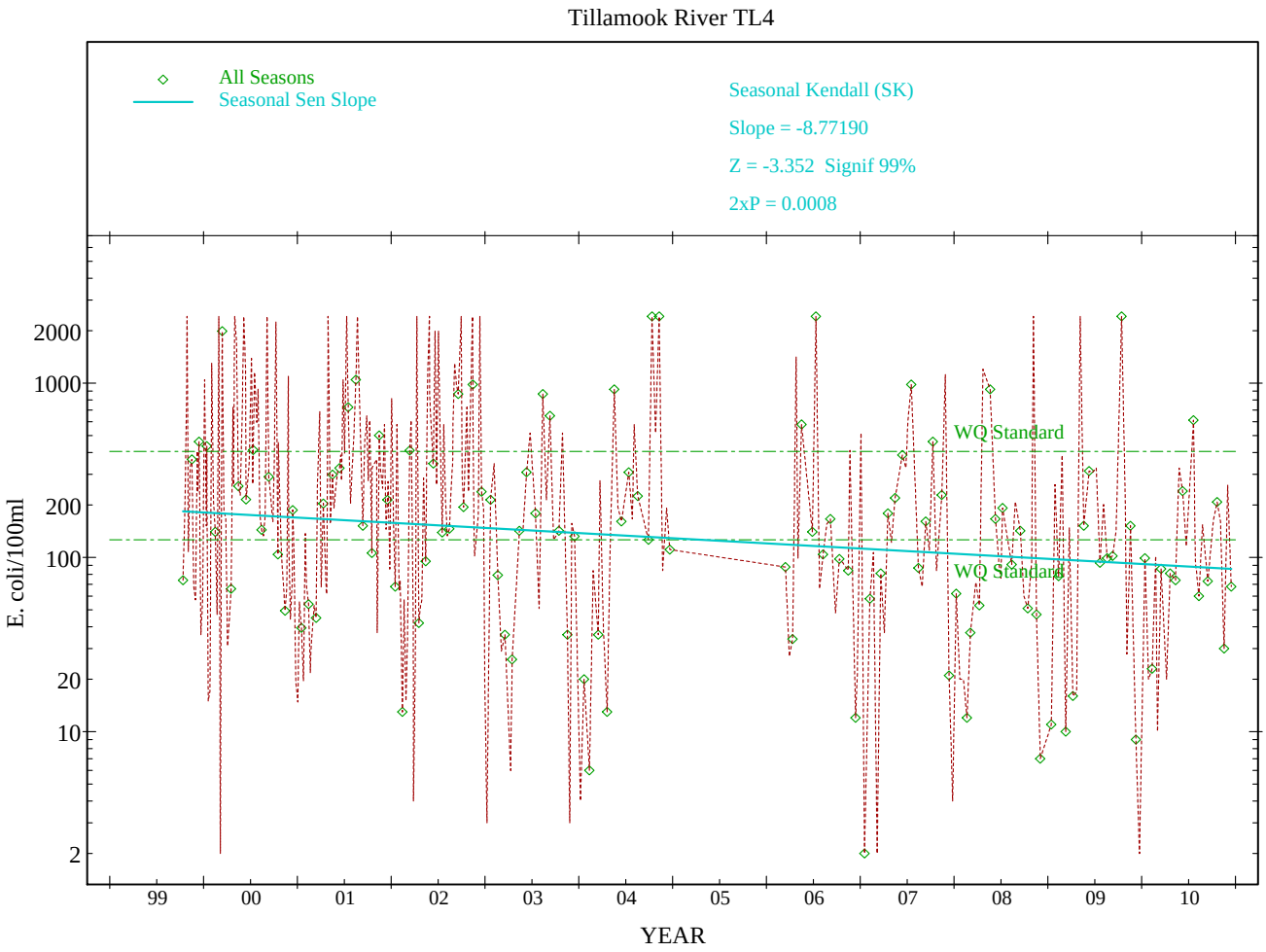

Figure A-6. Seasonal Kendall test results for site TL4 (1999-2010) on the lower Tillamook River mainstem.

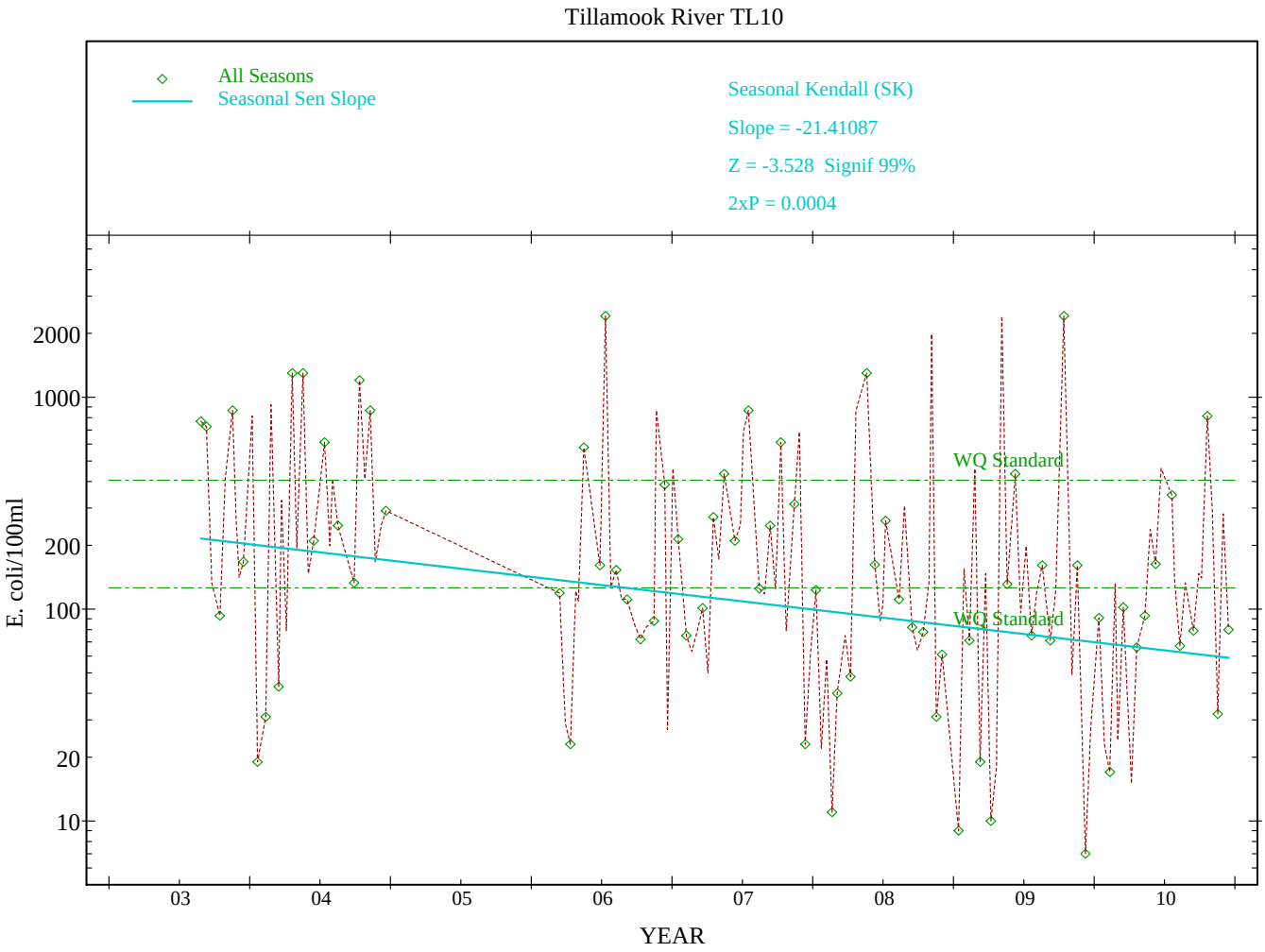

Figure A-7. Seasonal Kendall test results for site TL10 (2003-2010) on the lower Tillamook River mainstem.

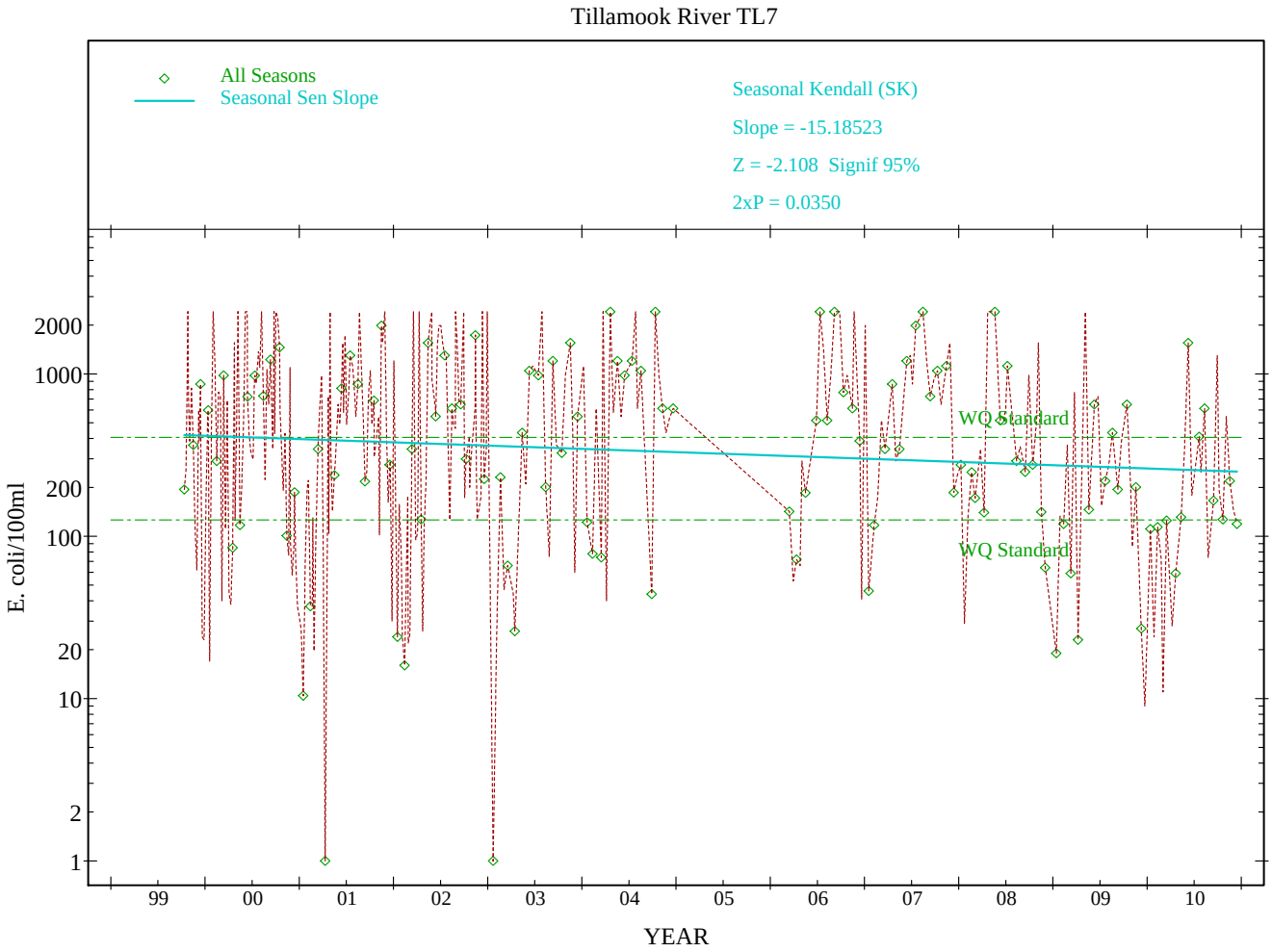

Figure A-8. Seasonal Kendall test results for site TL7 (1999-2010) on the upper Tillamook River mainstem.

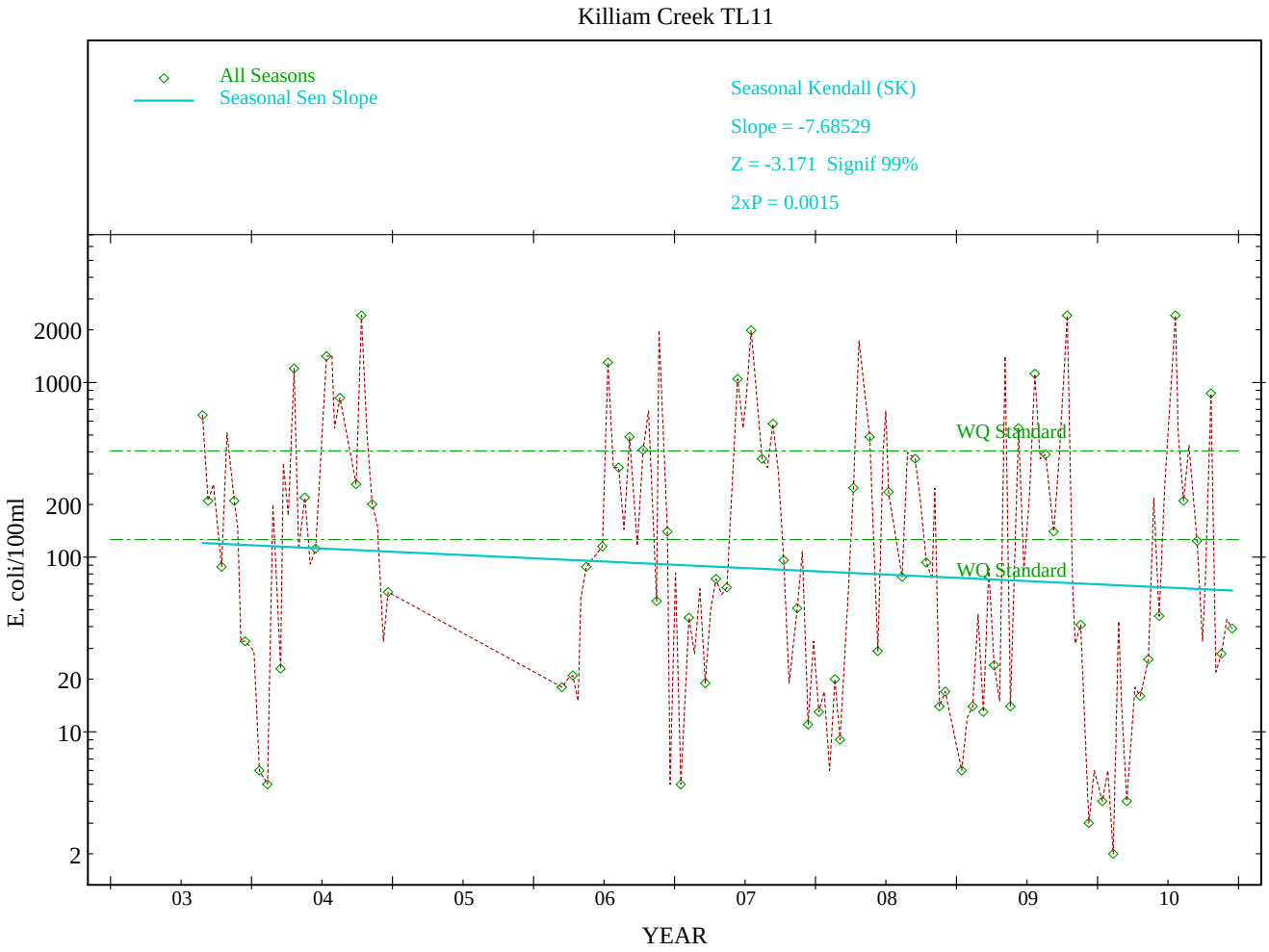

Figure A-9. Seasonal Kendall test results for site TL11 (2003-2010) on Killam Creek near its confluence with the Tillamook River.

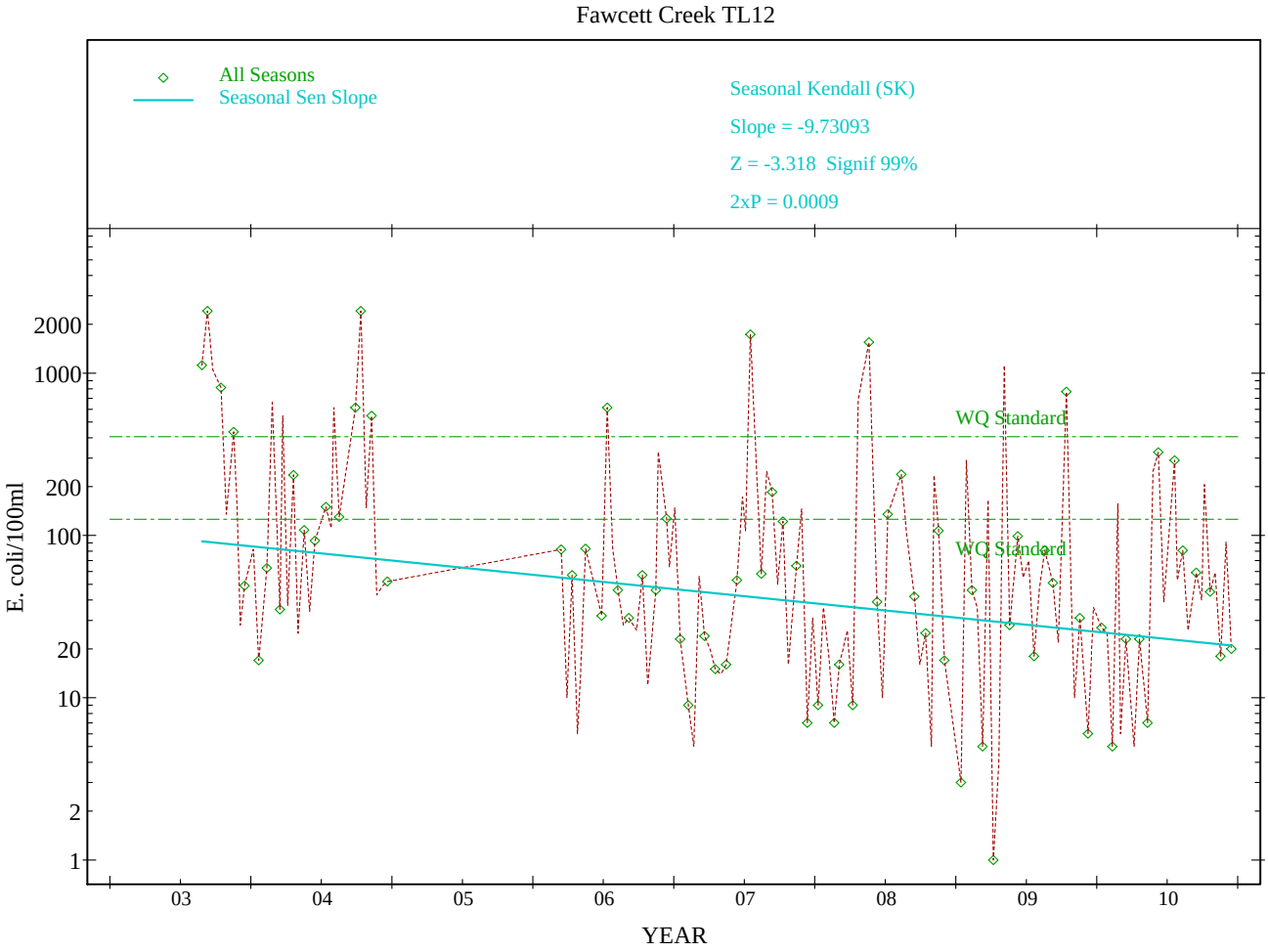

Figure A-10. Seasonal Kendall test results for site TL12 (2003-2010) on Fawcett Creek near its confluence with the Tillamook River.

Attachment B

Watershed Restoration Reduces Bacteria Levels in Oregon's Tillamook River Basin

SP-12 Submission Option 2a, Supporting Documentation

May 2011

BACTERIAL MONITORING AND WATER QUALITY STANDARDS

Tillamook Bay—Oregon's third largest estuary—supports a thriving commercial and recreational shellfishing industry. Unfortunately, bacteria concentrations found in all five of the Bay's major tributaries routinely violate state and Federal water quality standards, threatening human health and causing commercial harvest area closures.

As is often the case in estuaries across the country, Tillamook Estuaries Partnership (TEP) knew bacteria came from a combination of point and non-point sources including agricultural runoff, failing septic systems, overloaded municipal treatment plants, and urban stormwater. The tricky part was identifying exactly where these sources were delivering the largest loads and quantifying how much bacteria was threatening the Bay's health.

THE NATIONAL ESTUARY PROGRAM IN ACTION

Tillamook Estuaries Partnership

With its Comprehensive Conservation and Management Plan (CCMP) serving as a guide, the TEP launched an ambitious bacteria research and monitoring effort in the basin.

Data produced from this effort has allowed TEP to apply mitigation efforts exactly where they are needed in order to efficiently and effectively achieve water quality goals. In addition, bacteria data collected through TEP's monitoring was also used by the State of Oregon to create the Tillamook Bay Bacteria Total Maximum Daily Load (TMDL).

TEP began its monitoring program in 1996, launching an extensive Storm-Based Monitoring Program to identify and evaluate bacterial concentrations attributable to the watershed's different land uses. The effort also identified suitable long-term sampling sites for tracking the status and trends of bacteria throughout specific river reaches. A small team of dedicated volunteers joined the effort the following year, and 13,000 samples later, the TEP reported significant progress in 2007. TEP's trend data has led to some important discoveries, including the determination that forested areas of the watershed generally meet water quality standards for bacteria, indicating that forest wildlife is not a key contributor of bacterial contamination as some thought.

Working with Oregon State University researchers in 2001, the TEP began a three-year genetic marker study in the Tillamook Bay Watershed. The study enabled scientists to discriminate among bacteria from human and ruminant sources. Ruminant sources include cows, elk, and deer. Through the analysis, they

found widespread contamination from farm animal waste in specific segments of the river and high concentrations of human waste in other parts. Using the data, watershed managers can now build the best strategies for decreasing fecal pollution indicators in specific areas.

The TEP is working with agricultural landowners, including the local dairy cooperative, which made some important improvements to its discharge system so that its effluent no longer discharges directly into the Wilson River. With a credible, scientific framework the TEP has developed partnerships with local municipalities on habitat restoration and stormwater management projects. Additionally, TEP provides assistance to small landowners by helping to revegetate riparian areas on their property, and offers workshops and other educational opportunities about the importance of riparian owners and, for agricultural purposes, fencing off riparian areas to prevent livestock from entering streams and rivers. While the lower sections of four of the key rivers in the Tillamook Bay watershed still violate Oregon's water quality standards for recreational use, the fifth tributary, the Wilson River, has been in compliance since 2005, and statistically significant trends indicate that bacteria concentrations remain on a steady decline.

More than a decade's worth of status and trend information is paying off for the TEP with targeted approaches that support successful, efficient implementation of the Comprehensive Conservation and Management Plan. Investing in efforts that strategically target land uses that contribute to surface water bacteria is bringing the Tillamook Bay watershed closer to coming into compliance with state and Federal water quality standards.

Visit **www.tbnep.org** to learn more about this and other TNEP efforts.

EPA's National Estuary Program (NEP) is a unique and successful coastal watershed-based program established in 1987 under the Clean Water Act Amendments. The NEP involves the public and collaborates with partners to protect, restore, and maintain the water quality and ecological integrity of 28 estuaries of national significance located in 18 coastal states and Puerto Rico.

For more information about the NEP go to www.epa.gov/owow/estuaries.