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# Aquatic and Riparian Effectiveness Monitoring Program



Interagency Monitoring Program – Northwest Forest Plan Area



## 2016 Annual Report

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# Introduction



The Aquatic and Riparian Effectiveness Monitoring Program (AREMP) is a "Service First" program consisting of USDA Forest Service (FS) and USDI Bureau of Land Management (BLM) employees working together to monitor the effectiveness of the Northwest Forest Plan's (NWFP) Aquatic Conservation Strategy and the BLM's Western Oregon Plan Revision in maintaining and restoring watershed condition within the NWFP area. The NWFP provides management direction for 24 million acres of federal lands in western Washington and Oregon, and northern California (fig. 1). The purpose of this report is to highlight AREMP's monitoring efforts and support to local units in fiscal year 2016.

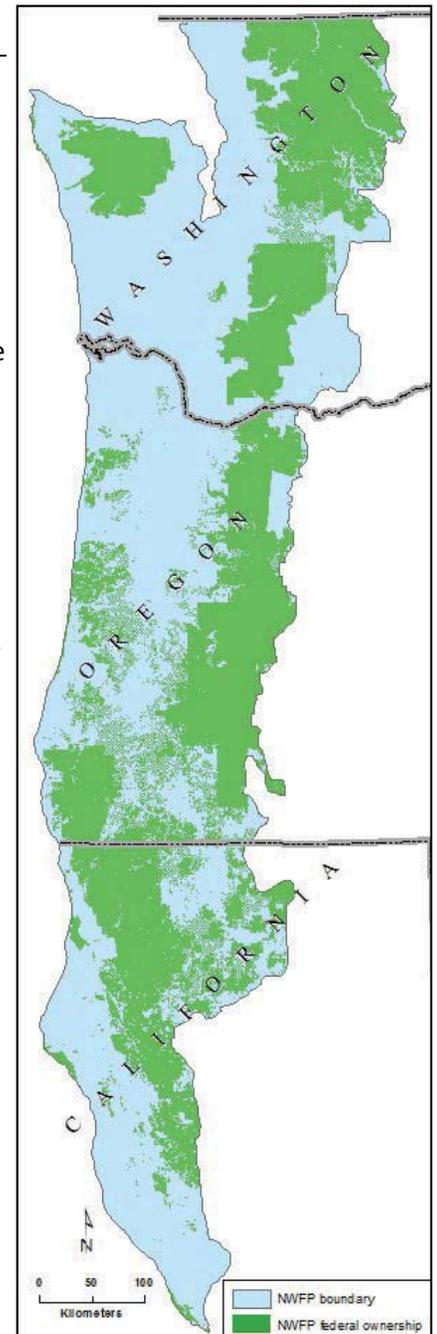
## Accomplishments



## 20-Year Report on Watershed Condition

The NWFP monitoring programs produce formal reports on a 5-year cycle, with the latest reports covering the period of 2009-2013. AREMP completed this report in 2015, but an additional review of the new methods used held up the report through 2016. Final publication is now expected in 2017.

These new methods included a shift from indicator evaluation criteria (desired habitat conditions) based on expert judgment to a more empirical "reference condition" approach, based on the distribution of values found in minimally human-disturbed sites for each vegetation zone and stream site type. This approach also helped to standardize assessments across aquatic provinces for more consistent and comparable results. Environmental variability was directly incorporated into the models by including information such as geology, landforms, and precipitation. Additionally, the upslope/riparian evaluation was restructured from evaluating indicators



**Figure 1.** Northwest Forest Plan (NWFP) area and federal lands being evaluated for watershed condition.

directly (road density, vegetation condition) to evaluating indicators as they explicitly contribute to key aquatic processes (sedimentation, wood delivery, riparian function, hydrology, and fish passage).

## Reference Site Network

The reference condition approach used in the 20-year report was underpinned by a 3-year cooperative effort involving AREMP, Oregon State and Utah State Universities, Oregon and California Departments of Fish and Wildlife, Oregon Department of Environmental Quality, and Washington Department of Ecology. A common protocol was used across agency databases to identify 5516 sites in the NWFP area with minimal human disturbance (Miller et. al 2016). This database is not only useful to AREMP but can be used to generate benchmark distributions for a variety of stream metrics for any location in the area. Comparison sites are chosen based on the nearest neighbor algorithm that uses a variety of environmental attributes (e.g., climate, geology, catchment size, elevation, etc.).

## Status and Trend Sampling

Monitoring is conducted at the subwatershed scale (US Geologic Survey 6th-field hydrologic unit code [HUC]). These subwatersheds (hereafter referred to as “watersheds”) are approximately 10,000 to 40,000 acres in size.

One hundred fifty-seven stream sites within 25 watersheds spread throughout the NWFP area were sampled during 2016 (fig. 2). These watersheds were sequentially sampled from the subset of the 250 watersheds originally selected for monitoring the NWFP. The 250 watersheds were selected at random using a generalized random tessellation sampling design, which guarantees a spatially balanced sample (Reeves et. al. 2004, Stevens and Olsen 2003, 2004). Eighteen sites were resurveyed as part of our quality control program.

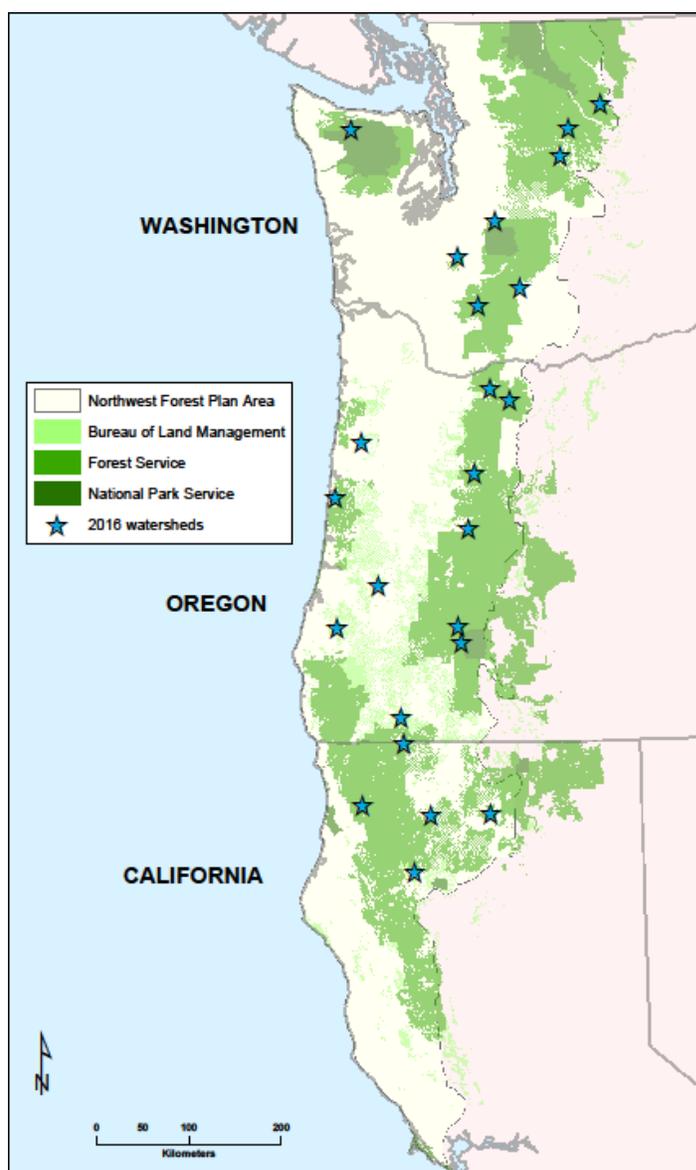
We made the following changes to the 2016 field sampling protocol to make our sampling more cost effective and time efficient:

- We no longer use an electronic laser and compass to collect channel morphology information. All data is

collected using a tape measure and stadia rod.

- Slope data is now collected using a site level.
- We collect eDNA samples for all sites.
- All data collection is done using Samsung (Android) tablets with Microsoft Excel form

## Landslide risk & Sediment Delivery



**Figure 2.** Map of the watersheds surveyed during the 2016 field season

## Modeling

Another product of the 20-year report process with multiple potential applications is a regional landslide risk/sediment delivery model created in cooperation with

Karen Bennett (USFS Regional Soil Scientist, now retired) and Carrie Gordon (Forest Geologist, Ochoco National Forest). The model builds on an earlier topography-only Netmap model used in the 15-year report, by adding factors for geology, landforms and precipitation zones. The USFS Region 6 recreation division participated in model development and is interested in applying it for planning for hazards to recreation and related infrastructure.

Chronic erosion from roads is another sediment delivery process that operates somewhat differently than the episodic risk from landslides. To better reflect this process, AREMP also began working with Charlie Luce from the Forest Service Rocky Mountain Research Station to use GRAIP-lite, a GIS based tool used to predict the relative intensity of road sediment impacts on streams (USDA FS RMRS 2016). The GRAIP-lite model does not include geology, landforms and precipitation factors, so AREMP staff have begun to test the integration of these elements from our landslide risk model. AREMP hosted an interagency meeting in April to present initial results and solicit feedback.

## Data Management

We re-designed our field data collection workflow, from the hardware used in the field, to the quality control steps, and final compilation. The new system uses modern tablet computers, more accurate Geographic Positioning System (GPS) technology, and an interactive analytical process for uploading to the final database. The new system provides a much lighter load for the crews, better quality control of data entry, the flexibility to work with different protocols, and is significantly less expensive than the equipment it replaced.

## Invasive Surveys

Aquatic and riparian invasive species continue to be a threat to our Pacific Northwest Ecosystems. With support from the Forest Service Region 6 Natural Resources, AREMP continues to perform invasive searches, reports detections, and can also provide probabilistic estimates of invasive trends. In 2016, AREMP crews surveyed 157 sites in 25 watersheds for aquatic invasive species throughout the field season (June through September).

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AREMP crews recorded 10 verified invasive detections, all of which were Himalayan [Armenian] blackberry (*Rubus armeniacus*).

## Assisting Local Units & Regional Initiatives



AREMP made several program adjustments in response to needs presented by the region and the local units. We continue to explore ways to better integrate regional scale monitoring with management unit planning and national landscape level initiatives. AREMP has substantial baseline data, and the tools necessary to assess change for evolving management across the landscape.

## Planning and NEPA Support

AREMP continued to make progress in making our data useful to a variety of other planning and environmental assessment processes.

From 2012-2016, BLM has been revising their westside management plans in Oregon in a process known as the Western Oregon Plan Revision (USDOI BLM 2016). AREMP contributed data for use in their draft and final environmental impact statements, and, at the request of the planning team, for the first time summarized our data by subdivisions for evolutionary significant units (ESUs) for threatened and endangered fish. In the final plan, AREMP continues to be identified as the principal source for effectiveness monitoring of aquatic resources.

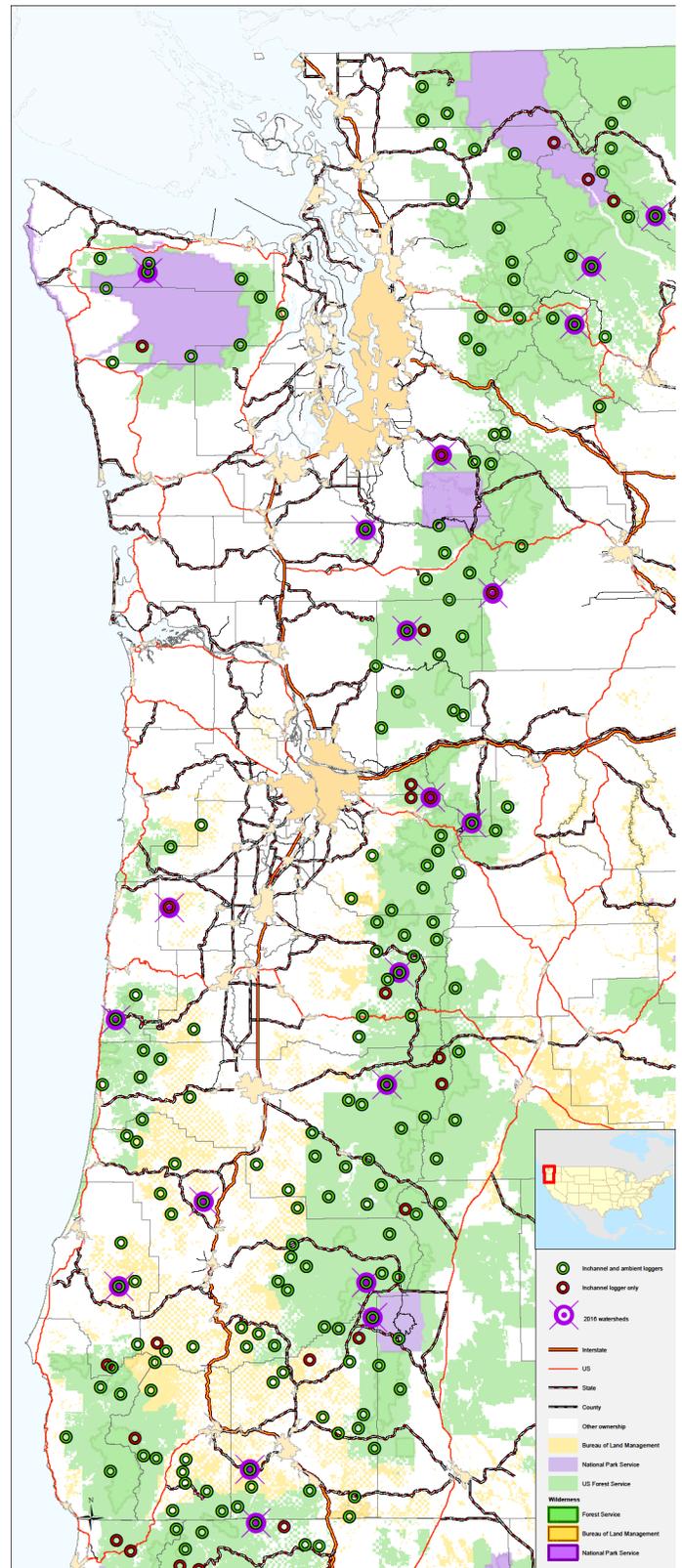
The USFS instituted the Watershed Condition Framework, a national watershed assessment, prioritization and restoration process (USDA FS 2011) in 2010. An initial assessment was completed in 2011, and a major 5-year update was done in 2016. The assessment model includes 12 indicators with 22 attributes (metrics). AREMP again contributed data for two indicators (riparian vegetation, road and trails) that were available for region 6 forests to use, instead of generating their own data.

The 2012 USFS Planning Rule, which provides the procedures to be used in revising national forest plans, calls for the responsible official to assess whether or not the plan components will provide the ecological conditions necessary to maintain a viable population of each species of conservation concern within the plan area. AREMP staff worked with regional fisheries staff to build a model based on the AREMP approach to use in these evaluations for fish species (fish viability model).

AREMP staff presented at two USFS subregional workshops aimed at training national forest staff on National Environmental Policy Act and biological assessment work. Workshops were held on the Deschutes National Forest in February and the Olympic National Forest in April. Staff presented potential applications of AREMP data for project and forest-level NEPA. Staff also prepared and delivered a presentation to the USFS R6 NEPA/planners annual meeting (March) on the potential uses of AREMP data in NEPA and planning.

## Stream Temperature Monitoring

AREMP continued our partnership with USFS Pacific Northwest Regional Office, BLM Oregon State Office, and US Geologic Survey (USGS) Forest Rangeland and Ecosystem Science Center to monitor year-round in-stream and air temperatures in watersheds throughout the Northwest Forest Plan Area in Oregon and Washington (fig. 3). The purpose of this ongoing partnership is to provide baseline year round air and stream temperature data to climate scientists, aquatic ecologists, fish biologists and hydrologists to help determine the sensitivity of stream temperature to climate change. Temperature data is shared with the USFS Rocky Mountain Research



**Figure 3.** Location of instream and air temperature sensors placed by AREMP in the Northwest Forest Plan area of Oregon and Washington. The purple bull's eye represents watersheds surveyed for stream condition by AREMP in 2016. The green circle designates AREMP watersheds with a stream-side and upslope air sensor. The red circle depicts AREMP watersheds with an instream sensor.

Station as part of the NorWeST regional stream temperature project which develops spatially explicit stream network models for climate change scenarios. Outputs from these models are available on the NorWeST website for use by biologists, hydrologists, and researchers to better understand thermal impacts on aquatic species and to help prioritize conservation efforts. Many watersheds were visited and several improvements were made for this effort:

- Continued to work with local Forest Service and BLM personnel for assistance with downloading thermographs.
- Monitored stream temperature in 138 watersheds throughout the Northwest Forest Plan Area in northern California, Oregon and Washington.
- Monitored stream side air temperature thermographs in 52 watersheds and upslope air temperature thermographs in 45 watersheds in Oregon and Washington. Upslope thermographs are located 300 to 700 ft. (91 to 214 m) in elevation above the stream side thermograph.

## Surface Water Diversion Surveys

Over 65,000 surface water diversions are thought to be on Forest Service lands; however the spatial data regarding withdrawal locations and status are often inaccurate or missing. Given the danger of these structures to entraining fish and blocking migration, the USFS Pacific Northwest Regional Office (RO) and AREMP began a partnership in 2014 to collaborate with National Forests in Region 6 to inventory and collect data on stream diversion structures. The RO and AREMP provided a protocol for Forest Interdisciplinary teams to identify and prioritize diversions to be surveyed as well as a protocol to inventory diversions in the field. In 2016 AREMP:

- Improved the instructions and forms based on user feedback;
- Continued to accept survey data and organize photographs, forms and other notes; and
- AREMP field crews surveyed 18 diversions to assist the Mt Baker-Snoqualmie National Forest.

## Culvert Surveys

Crew surveyed 19 culverts post-restoration as part of the Salmon Super Highway project to assess fish passage using the Forest Service National Inventory and Assessment Procedure for Identifying Barriers to Aquatic Organism Passage at Road-Stream Crossings (Clarkin et al 2005). The Salmon Super Highway project is an ongoing partnership between the federal, state, and county governments, non-profit organizations, and local businesses. The overall goal of the partnership is to restore fish habitat in Oregon's North Coast, including the six adjacent major river systems that drain from the Coast Range into Tillamook and Nestucca bays. For further information on this partnership visit - <http://www.salmonsuperhwy.org/>.

## Program updates

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## Employment

We employed seven year-round employees who were a combination of permanent and year-round "term" employees. Seventeen crew members were employed between May - October; they were a combination of seasonal employees and American Conservation Experience interns (ACE). AREMP Summer employment information is posted at: <https://www.fs.fed.us/r6/reo/monitoring/employment/>.

Stephanie Miller, AREMP Program Lead, accepted a new

position as the BLM National Riparian Lead in the Washington Office.

## Youth Hires

AREMP hired 17 youth employees (under age 35) to assist with field sampling in 2016. Youth hires included eight seasonal BLM employees and 9 interns. Interns were hired in cooperation with the American Conservation Experience (ACE) program. Those interns age 25 or younger at the time of hiring were eligible to receive a direct hiring authority via the Public Land Corps Act (PLCA) after successfully completing at least 640 hours of service. This hiring authority conveys the ability to apply to government only (“merit”)



position vacancies with all federal government agencies for 120 days after internship completion. Interns are also eligible for AmeriCorps Education awards up to \$1500 which can be used to pay education costs at qualified institutions of higher education, for educational training, or to repay qualified student loans.

The AREMP team provides additional training and encouragement on applying for federal jobs, resumes reviews and opportunities to speak with federal managers and biologists to learn about federal jobs. Each crew member attends three weeks of training to learn how to conduct AREMP stream surveys, this includes one week of field training during which the participants camp in the field to practice surveys before heading out on 8 day stints during the field season. Additionally, AREMP provides training in wilderness first aid, CPR, blood-borne pathogens and how to administer epinephrine pens., annual defensive driver training to operate federal vehicles, a ride-along for crew members with BLM Safety Officers to practice driving on gravel roads and a “right to know” training which covers all the po-

tentially hazardous chemicals they may come in to contact with for preserving samples and calibrating water quality meters.

## Safety Awards

AREMP employees were honored to receive the 2016 Region 6 Regional Safety Manager’s Special Recognition Safety Award and the 2016 BLM OR/WA State Unit Safety and Health Award. Both of these awards recognized AREMP’s commitment to creating a safety culture that empowers employees to keep safety as their top priority. From our field supervisors down to stream survey interns, there is never a question that working safely is our program’s top priority. Safety in the field is woven into the AREMP culture such that it is not a burden, but part of the daily job.

## AREMP Projects for Coming in 2017

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## 20 and 25-Year Reports on Watershed Condition

The final 20-year report (1994-2013) was published in 2017 as a Forest Service general technical report and will be available on the Regional Ecosystem Office website: <https://www.fs.fed.us/r6/reo/>.

Planning for the 25-year report is already underway. Two additional scientists have been recruited to help with the

content and analysis:

- Rebecca Flitcroft is a research fish ecologist with the USDA Forest Service PNW Research Station. Her work has focused on the evaluation of salmon habitat, particularly in coastal Oregon, and the influences of fire and climate change.
- Jason Dunham is a supervisory research ecologist with the USDI Geological Survey. His work focuses on the landscape ecology of aquatic ecosystems, conservation biology of focal species, ecology of natural disturbance, and biological invasions.

## Data and documentation

Along with delivery of the 20-year report, AREMP will provide the documented data that went into the report as downloadable GIS layers and data tables (<https://reo.gov>).

Metadata and documentation for our stream survey data will also be updated to comply with BLM metadata requirements in preparation for delivery to the BLM.

## Planning and NEPA Support

AREMP will continue to explore ways to make our data useful to a variety of other planning and environmental assessment processes. A particular emphasis will be on automating methods for summarizing our data for individual management units (national forests, BLM districts, etc.).

## NWFP Science Synthesis

The U.S. Forest Service Pacific Northwest (which includes Oregon and Washington) and Pacific Southwest (which includes California) Research Stations are developing a science synthesis to inform the revision of land management plans (forest plans) for 17 national forests within the Northwest Forest Plan (NWFP) area. AREMP assessment results are incorporated into a chapter on aquatic and riparian species and ecosystems, and two AREMP personnel are participating as co-authors. Details can be found at: <https://www.fs.fed.us/pnw/research/science-synthesis/>.

## GRAIP-lite

AREMP will continue to work with Charlie Luce from the Forest Service Rocky Mountain Research Station to adapt the GRAIP-lite road sediment delivery model for use in the 25-year assessment.

## Environmental DNA (eDNA) Sampling

eDNA is a surveillance tool used to detect genetic material in aquatic ecosystems and determine species presence. We are working with Dr.(s) Brooke Penaluna and Richard Cronn from the USFS Pacific Northwest Research Station this winter on sample design and field collection protocols to collect samples during the 2016 field season across the NWFP area. Crews will collect additional eDNA samples for a study that will examine the efficacy of using eDNA to detect invasive species in lakes and reservoirs.

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## Acknowledgements

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Jim Capurso (FS R6) funded aquatic invasive species monitoring.

Brian Staab (FS R6) and Louisa Evers (BLM OSO) helped procure funding for deploying thermographs.

The BLM Oregon/Washington State Office Budget and Finance, Human Resources and Mobile GIS Specialists for support and guidance.

Oregon State University Oregon Sea Grant Extension and Portland State University provided training, support and guidance in the implementation of the invasive species monitoring protocol.

Summer field staff for assessing stream condition included: Abbie Ernst, Alex Hughan, Mercy Iyere, Erik Johnson, Sarah Kintner, Christina Linkem, Daniel Lord, Jesse Miller, Megan Moore, Morganne Price, Tammy Quintano, Jenny Reeder, Cris Salazar, James Stockdale, Jaron Tylock, Seth Webster, and Alanna Wong.

Hydrologists and Fish Biologist from local FS, BLM and NPS units assisted with downloading thermographs throughout the NWFP area.

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**Please visit our website for more information:**

<http://www.reo.gov/monitoring/watershed-overview.shtml>

# Appendix A—Watersheds Surveyed in 2015 and 2016

Watersheds surveyed in 2015 and 2016 with the number of sites surveyed in each watershed. Sites where quality assessment/quality control (QA/QC) were also conducted are denoted by (# sites). QA/QC sites are where a second independent crew returned to sample the same reach to determine variability in our measurements.

## Watersheds surveyed in 2015

State	Province	Local Unit	6th Field HUC	6th Field HUC Name	Creek Code	County	# Sites
CA	Klamath/Siskiyou	Klamath	180102090303	Lower Elk Creek	CALEK	Siskiyou	8 (2)
CA	Klamath/Siskiyou	Shasta-Trinity	180102120305	Olsen Creek-Hayfork Creek	CAGRS	Trinity	8 (2)
CA	High Cascades	Shasta-Trinity	180200040301	Upper Squaw Valley Creek	CAPTH	Siskiyou	6
CA	Klamath/Siskiyou	Shasta-Trinity	180102120301	Salt Creek	CAPHL	Trinity	5
CA	Klamath/Siskiyou	Redding	180102110702	Grass Valley Creek	CAGRV	Trinity	6
CA,OR	Klamath/Siskiyou	Klamath	180102060903	West Fork Beaver Creek	CABER	Siskiyou	7 (1)
OR	Washington/Oregon Coast Range	Coos Bay	171003030401	Paradise Creek	ORPDS	Douglas	8 (2)
OR	Franciscan	Siskiyou	171003120501	Upper Hunter Creek	ORHTR	Curry	9 (2)
OR	Washington/Oregon Coast Range	Siuslaw	171002050704	Mercer Lake-Frontal Pacific Ocean	ORMER	Lane	4
OR	Western Cascades	Willamette	170900010703	Dexter Reservoir-Middle Fork Willamette River	ORLOK	Lane	8
OR	Western Cascades	Medford	171003070504	Flat Creek-Elk Creek	ORHWK	Jackson	4
OR	Western Cascades	Mt. Hood	170900110101	Upper Hot Springs Fork Collawash River	ORHOT	Clackamas/Marion	6
OR	Klamath/Siskiyou	Siskiyou	171003110203	Grayback Creek	ORGRY	Josephine	7
OR	Washington/Oregon Coast Range	Medford	171003020803	Elk Valley Creek-West Fork Cow Creek	OREKV	Douglas	5
OR	Western Cascades	Umpqua	171003011006	Upper Cavitt Creek	ORCVT	Douglas	7
WA	North Cascades	Mt. Baker-Snoqualmie	171100090303	Lower South Fork Skykomish River	WALSS	Snohomish/King	6 (1)
WA	Olympic Peninsula	Olympic	171100180701	Spencer Creek-Frontal Dabob Bay	WAMAR	Jefferson	6 (2)
WA	North Cascades	Mt. Baker-Snoqualmie	171100050707	Lake Shannon-Baker River	WALBK	Skagit/Whatcom	9 (2)
WA	High Cascades	Gifford Pinchot	170701050904	Middle Little White Salmon River	WALWS	Skamania	10 (3)
WA	North Cascades	Mt. Baker-Snoqualmie	171100060105	Lower White Chuck River	WALWC	Snohomish	6
WA	Olympic Peninsula	Olympic NP	171001010601	North Fork Sol Duc River	WASOL	Clallum	6
WA	High Cascades	Mt. Baker-Snoqualmie	171100140305	Upper Greenwater River	WUAUGR	Pierce	8
WA	Olympic Peninsula	Olympic	171100200305	Lower Gray Wolf River	WAGWR	Clallum	6
WA	North Cascades	Mt. Baker-Snoqualmie	171100090203	Lower Beckler River	WABEC	King/Snohomish	5

## Watersheds surveyed in 2016

State	Province	Local Unit	6th Field HUC	6th Field HUC Name	Creek Code	County	# Sites
CA	Klamath/Siskiyou	Shasta-Trinity	180102110705	Weaver Creek	CAWVR	Trinity	8 (1)
CA	Klamath/Siskiyou	Klamath	180102080103	Lower East Fork Scott River	CANOY	Siskiyou	8 (2)
CA	High Cascades	Shasta-Trinity	180200040106	Lower Ash Creek	CASSH	Siskiyou	11 (3)
CA	Klamath/Siskiyou	Six Rivers	180102090801	Camp Creek	CACDR	Siskiyou	6
CA	Klamath/Siskiyou	Klamath	180102080602	Boulder Creek-Scott River	CAEMI	Siskiyou	4
CA,OR	Klamath/Siskiyou	Rogue River	171003090103	Dutch Creek-Elliott Creek	ORLEL	Siskiyou	4
OR	High Cascades	Mt. Hood	170701050501	Upper East Fork Hood River	OREFH	Hood River	8 (1)
OR	High Cascades	Rogue River	171003070105	Foster Creek-Rogue River	ORFST	Klamath/Douglas	7 (1)
OR	Western Cascades	Umpqua	171003010401	Upper Fish Creek	ORCLR	Douglas	9 (2)
OR	Washington/Oregon Coast Range	Siuslaw	171002050405	Eckman Creek-Alsea River	ORALS	Lincoln	5
OR	Western Cascades	Willamette	170900050301	Upper Blowout Creek	ORBWL	Linn	5
OR	Western Cascades	Mt. Hood	170800010501	Blazed Alder Creek	ORB LZ	Clackamas	6
OR	Klamath/Siskiyou	Medford	171003090403	Humbug Creek-Applegate River	ORCHP	Jackson	6
OR	Washington/Oregon Coast Range	Coos Bay	171003050305	Elk Creek	OREKK	Coos	6
OR	Washington/Oregon Coast Range	Salem	171002040402	Lower North Fork Siletz River	ORSTZ	Polk	5
OR	Western Cascades	Willamette	170900040307	Cougar Reservoir-South Fork McKenzie River	ORWLK	Lane	6
OR	Washington/Oregon Coast Range	Roseburg	171003030206	Yellow Creek	ORYEL	Douglas	5
WA	North Cascades	Wenatchee	170200110702	Chiwaukum Creek	WACWK	Chelan	8 (2)
WA	North Cascades	Wenatchee	170200110203	Chikamin Creek	WALCH	Chelan	7 (2)
WA	Western Cascades	Gifford Pinchot	171100150111	Little Nisqually River	WANIS	Lewis	8 (2)
WA	High Cascades	Gifford-Pinchot	170800040302	Walupt Creek	WAWPT	Lewis	6 (2)
WA	Western Cascades	Mt. Baker-Snoqualmie	171100140402	Clearwater River	WACL R	Pierce	4
WA	Western Cascades	Gifford-Pinchot	170800020202	Clearwater Creek	WACWC	Skamania	6
WA	North Cascades	Okanogan	170200080704	Gold Creek	WAGOL	Okanogan	4
WA	Olympic Peninsula	Olympic NP	171001010602	Headwaters Sol Duc River	WASDR	Clallum	5