Stormwater Action Monitoring

Puget Small Streams Study Design

Receiving Waters

Lead Entity

Stormwater Action Monitoring Staff

Partners

U.S. Environmental Protection Agency

U.S. Geological Survey

Washington State Department of Ecology

Puget Sound Partnership

King County

Washington Department of Fish and Wildlife

Washington Department of Natural Resources

Collectively improving stormwater management

Stormwater Action Monitoring (SAM) is a collaborative, regional stormwater monitoring program that is funded by more than 90 Western Washington cities and counties, the ports of Seattle and Tacoma, and the Washington State Department of Transportation. SAM's goal is to improve stormwater management to reduce pollution, improve water quality, and reduce flooding. We do this by measuring stormwater impacts on the environment and evaluating the effectiveness of stormwater management actions.

Questions about SAM?
See ecology.wa.gov/SAM

Project purpose

SAM is monitoring small stream conditions over time to see if they are getting better or worse in urban and urbanizing areas of Puget Sound. A group of scientists spent two years reviewing the previous stream monitoring study findings and other literature to recommend adjustments to the monitoring design.

The Puget Small Streams (PSS) design improves statistical robustness and monitoring efficiency and will capture year-to-year climate variations. This improved design can be conducted with the current level of funding from municipal stormwater permittees participating in SAM.

Stormwater management problem

We need to know what combinations of management approaches are working, or not working, to prevent stormwater from harming streams. While SAM effectiveness studies provide useful information about specific methods, regional-scale monitoring tells us whether collective stormwater management efforts in the region are meeting our goals to protect and recover water quality and biota in streams. Stormwater managers need information at multiple scales from site-specific to region-wide.

The new streams status and trend monitoring study design

The first SAM Puget Lowland Ecoregion Streams (2015 PLES) study planned to evaluate 100 sites once every five years, with half of the sites inside and half outside designated Urban Growth Area boundaries. Site candidacy was based on stream order.

The new PSS study design, starting in 2020, improves statistical robustness and trend detection power, better captures annual climate variability, and is less expensive to implement than the 2015 PLES design.

Sampling sites selected for the PSS study design represent the full range of urban and urbanizing conditions across the region using a probabilistic design approach. The Generalized Random Tessellation Stratified survey design tool selected 6,316 candidate sites spaced one kilometer apart in the updated National Hydrography Dataset (NHD Hi-resolution, 1:24K or higher). The candidate sites are stratified into four groups based on the percentage of total impervious cover (TIC) in the contributing watersheds to ensure annual sampling of sites in each development range: least developed areas (0-<10% TIC), and low (10-<20% TIC), medium (20-<40% TIC), and high (40-100% TIC) developed watersheds.

Each sampling site must be a perennial, wadeable stream segment with contributing watershed size between 0.5-70 km^2 (0.2-27 mi^2). Starting in 2020, a total of 33 sites will

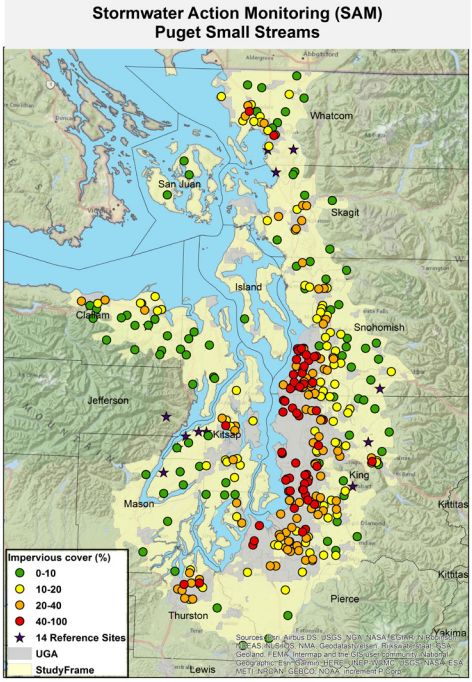

Figure. Sampling sites in next 20 years, grouped by category of total impervious cover (TIC) of the watershed area contributing to each site.

Publication Number 26-10-031

be sampled every year. Each year, nine sites will represent each category of least, low, and medium TIC watersheds and six sites will represent high TIC watersheds. All sites will be field evaluated and confirmed the year prior to sampling.

Trend detection power is increased by a 'revisit' approach introduced in the PSS design where each new site will be sampled three times at five-year intervals. Each year, some sites will be sampled for the first time while others will be sampled for the second or third time. Some 2015 PLES sites met the updated site selection criteria and will be sampled three more times in next 20 years.

The new design includes the 2015 PLES indicators that were most frequently detected and showed more differences by urban development gradient. The PSS indicators are: sediment chemistry including metals (total arsenic, cadmium, chromium, copper, lead, and zinc) and organics (polycyclic aromatic hydrocarbons, polybrominated diphenyl ethers, and phthalates); biotic indices (macroinvertebrates, periphyton, and physical habitat); and water quality including temperature, dissolved oxygen, total suspended solids, nutrients, metals (total and dissolved arsenic, cadmium, chromium, copper, lead, and zinc), chlorophyll-a, and bacteria (fecal coliform and *E. coli*). Continuous water level will be monitored at each site for a full water year to improve our understanding of stream hydrology.

Reporting will include annual assessment of the fractions of all stream miles in good, fair, and poor condition and the fractions of stream miles that are above and below benchmarks including water quality standards. In addition, trends analyses and risk assessments will be conducted every four years to identify the key stressors causing poor conditions in the region.

Why does this study matter?

Under Ecology's municipal stormwater permits, local governments are investing hundreds of millions of dollars each year managing stormwater. We need a way to know whether, why, and how well these investments are collectively working to protect and improve stream conditions.

What will Ecology do with this information?

Ecology will use this study to track progress in reducing stormwater impacts on streams and evaluate overall and long-term effectiveness of municipal stormwater permits.

What should we do with this information?

As we continue to track regional conditions and identify key stressors and pollutants impairing stream health, local officials and stormwater managers will be able to compare their stream conditions with others in the region and prioritize and focus their management practices. State and local agencies can use this information to develop regional protection and restoration strategies and evaluate the effectiveness of those programs.

For more information?

SAM status & trends webpage provides more information on the revised study design, sampling site locations, the sampling quality assurance project plan (QAPP), and more.

Publication Number 26-10-031

This was written by the SAM program for the Department of Ecology. It was originally hosted on EZview and was transferred to Biblio for records purposes as a publication in 2026.

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Publication Number 26-10-031