Welcome to the Stormwater Work Group's Status & Trends Subgroup

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SAM Scientist
July 24, 2025

Proposed S&T Subgroup Misson & Goal

Mission

To bring together regional scientific expertise to guide long-term monitoring programs and support collective learning about improved stormwater management.

Goal

To recommend robust methods for collecting data and analyzing trends in water quality, habitat, and biological health. Help regional partners evaluate whether our stormwater efforts are protecting and improving aquatic ecosystems.

Regulatory Context for SAM and How SAM Works

SAM is a new approach

- Replaces monitoring by individual MS4 permittees that was
  - Compliance focused
  - Complicated and expensive
- Permittees requested a different approach
- PCHB agreed
- Huge effort to launch and maintain

Investigations to answer key questions

Receiving Waters

- Are we protecting receiving waters?
- Are conditions getting better or worse?

Effectiveness Study

Source Identification

- What works and under what conditions?
- How can we better address common problems?

So many things we might monitor…

Who gets to decide?

Everyone gets to weigh in

- Stormwater Work Group is SAM's Steering Committee
  - Sets priorities
    - Sends recommendations to Ecology
  - Selects and approves studies
  - Formal oversight process

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Learn more about SAM

www.ecology.wa.gov/SAM

Are we protecting receiving waters?

Q.1. What is the **current condition** of receiving waters in the Puget Sound & Lower Columbia River Basins?

Q.2. How does the condition of receiving waters **change over time** in relation to urban growth and stormwater management efforts in the region?

Draft Near-term Work Plan

a. Assemble group of water quality scientists and ecologists with expertise in the Puget Sound and Lower Columbia River basins.

b. Revisit the purpose of the S&T data analysis, the data sources, and the expected outcomes.

c. Make recommendations to SWG on data analysis procedures. This could include questions and statistical methods for analysis.

d. Make recommendations to SWG on how data analysis should be conducted –in an IAA with a gov't agency, award a contract through an RFP process, or another avenue.

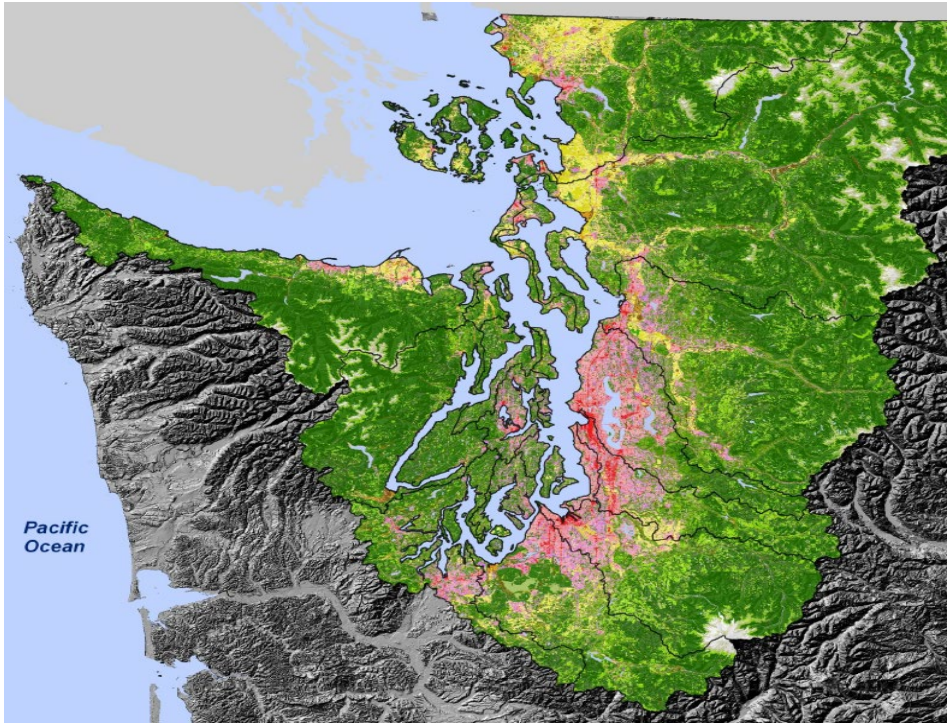
Draft Longer-term Work Plan

e. Consider adding new parameters (e.g. 6PPDQ, PFAS, alkylphenols)

f. Make recommendations to SWG on new studies (e.g. nearshore sediment, pesticides)

g. Other ideas?

SAM Receiving Water Monitoring from 2013-2018

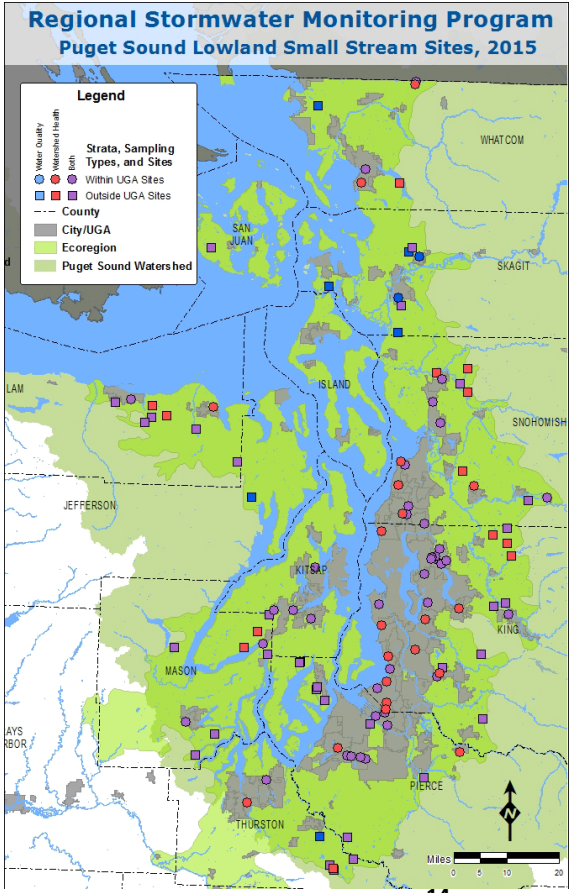


Status and Trends receiving water studies: 2013-2019

- Puget Lowland Ecoregion Streams
- Puget Lowland Streams Pesticide Pilot
- Puget Sound Nearshore Mussel Monitoring
- Puget Sound Nearshore Sediment Monitoring
- Puget Sound Nearshore Bacteria Review

Puget Lowland Ecoregion Streams

- **USGS**, **King Co**, **San Juan Island CD**, **Snohomish Co**, & **Ecology** sampled 100 sites within and outside urban growth area **(UGAs)**
- In **2015**, the team collected:
  - Monthly water quality sampling
  - Single summer watershed health monitoring event



Puget Lowland Ecoregion Streams Findings

Comparison to standards

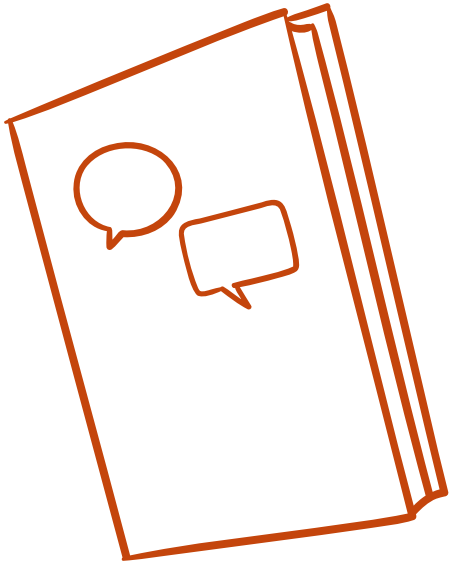
- Criteria exceedances were not a widespread problem.
  - Within UGAs: streams in poorer condition for fecal coliform and total phosphorus
  - Outside UGA: metals typically below acute or chronic standards

DeGasperi, C. L., Sheibley, R. W., Lubliner, B., Larson, C. A., Song, K., & Fore, L. S. (2018). Stormwater action monitoring status and trends study of Puget lowland ecoregion streams: evaluation of the first year (2015) of monitoring data. Prepared by King County.
https://green2.kingcounty.gov/ScienceLibrary/Document.aspx?ArticleID=530

Important stressors for B-IBI scores

Stream Health Category	Significant Stressors
Land cover	• Watershed Canopy Cover • Riparian Canopy Cover • Percent Urban Development
Water	• Total Nitrogen • Total Phosphorus
Sediment	• Total Zinc • Substrate Embeddedness • Substrate Particle Diameter

Puget Lowland Streams Pesticide Pilot Findings



- While a great number of pesticides were successfully characterized, **future work** needs to pursue lower method reporting limits.

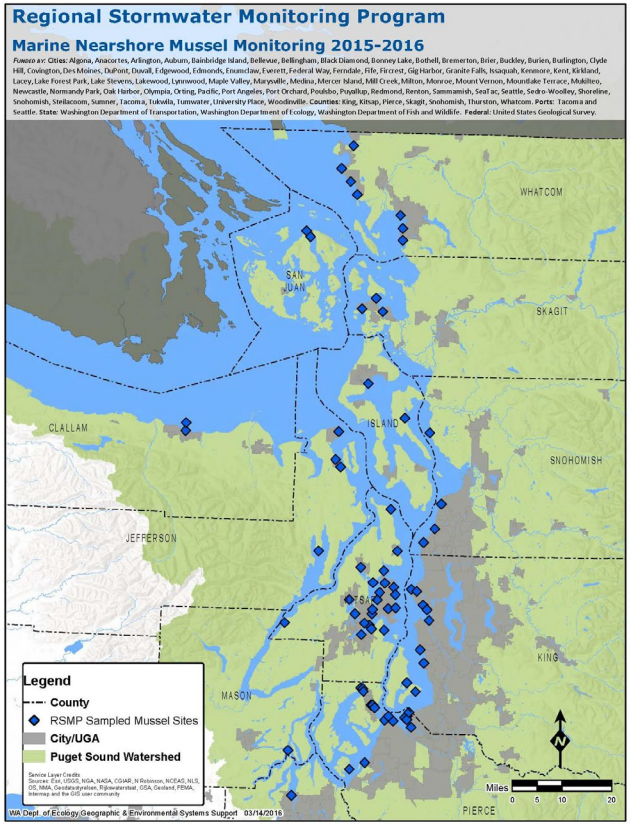
Nickelson, A., (2018). Data Report: Pilot Study of Pesticides in Washington State Stream Sediments. WA Dept. of Agriculture. https://cms.agr.wa.gov/WSDAKentico/Documents/DO/NRAS/741-PesticidesInSedimentReport.pdf

Puget Sound Nearshore Mussels

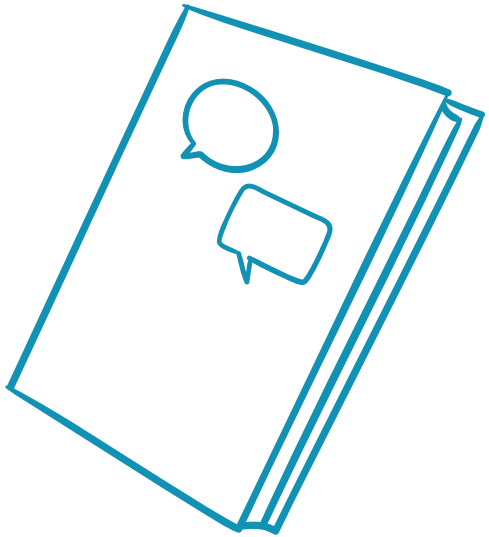
WDFW deployed caged mussels in winters

- 2015/16
- 2017/18
- 2019/20

at **40 sites** within urban growth area (**UGAs**)



Puget Sound Nearshore Mussels Findings

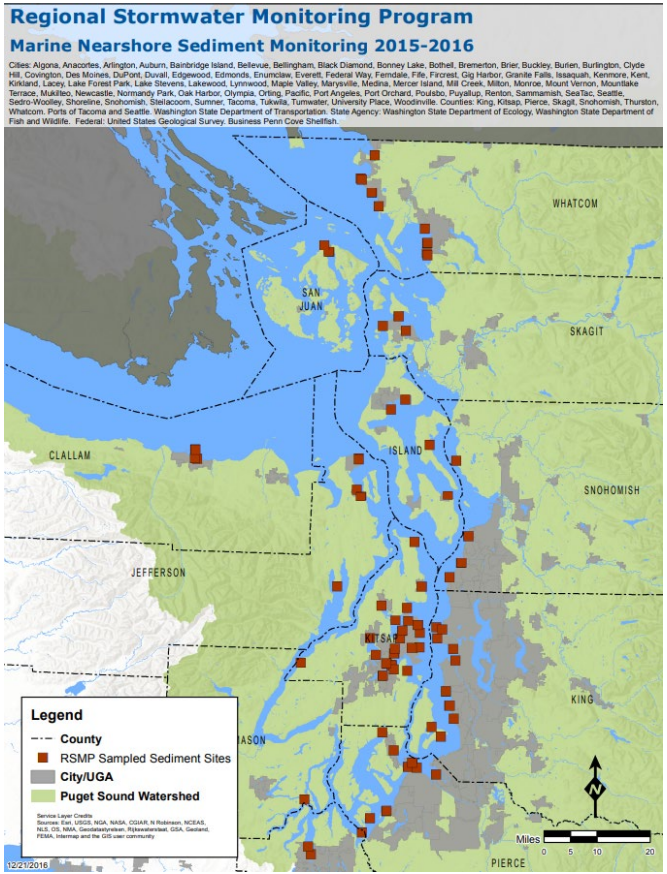


- Mussels are effective biotic endpoint in the nearshore environment and are a good tool for our study design.
- **PAHs**, **PCBs**, **PBDEs**, and **DDTs** were the most abundant organic contaminants in mussel tissue
- Concentrations significantly higher in urbanized areas as measured by -
  - City vs. Unincorporated UGA
  - Watershed impervious surface
- Concentrations of metals in mussel tissue were relatively low

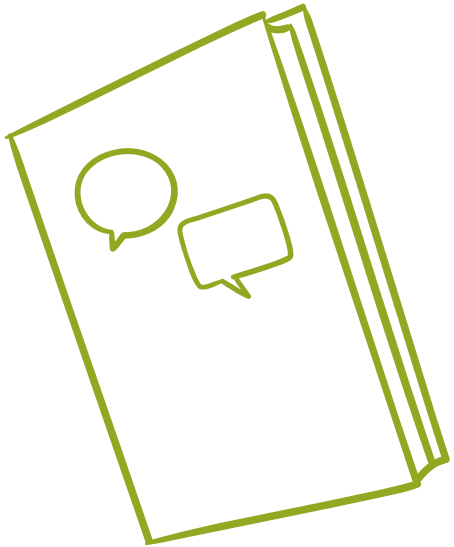
Langness, M., Nordstrom, D., & West, J. (2022). Stormwater Action Monitoring 2019/2020 Puget Sound Nearshore Mussel Monitoring Survey. WA Dept. of Fish & Life. https://wdfw.wa.gov/publications/02544

Puget Sound Nearshore Sediment

USGS, **WDNR**, and **King Co** sampled marine nearshore sediments along the urban nearshore during the **summer of 2016**, at many of the same sites as the SAM mussels study.



Nearshore Sediment Findings



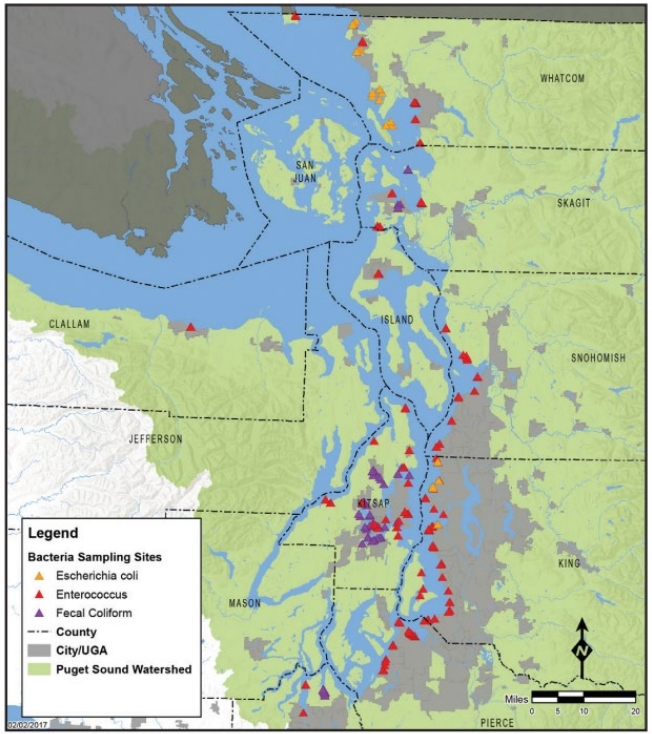
- Sediment chemical concentrations are **generally low** and below current State criteria.
- Sediment chemical concentrations not related to land cover, like mussel data showed.
- Current randomized probabilistic design appropriate for Puget Sound status and trends. **Future sampling** of nearshore sediment needs to take the effects of **drift cells** into consideration.

Black, R. W., Barnes, A., Elliot, C., & Lanksbury, J. (2018). Nearshore Sediment Monitoring for the Stormwater Action Monitoring (SAM) Program, Puget Sound, Western Washington (No. 2018-5076). US Geological Survey. https://doi.org/10.3133/sir20185076

Puget Sound Nearshore Bacteria Review

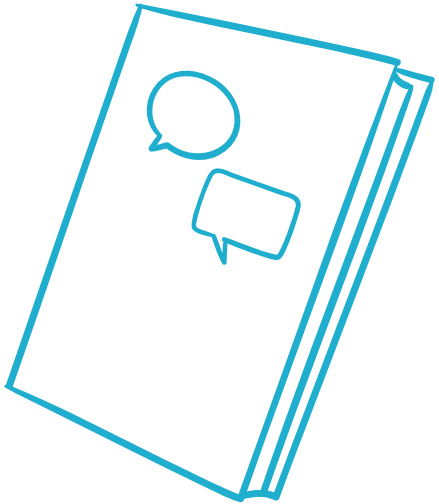
Ecology and **WA Dept of Health** compiled data from **27 entities** from **2010-2015**. No new sampling conducted.

Shoreline bacteria sampling locations



Service Layer Credits
Sources: Esri, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyreisen, Rijkwaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

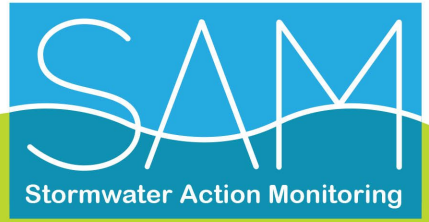
Puget Sound Nearshore Bacteria Review Findings



- A new regional sampling program does not appear to be needed.
  - Puget Sound is too large for a storm chasing focus, and ambient bacteria levels tracked by BEACH and DOH Shellfish sound-wide.
- If a new stormwater bacteria focus, then:
  - Find sites co-located with **outfalls** or **mouths of rivers** and **streams** that drain **densely populated urban areas**.
  - Standardize method of collection.
  - Consider effectiveness study objectives where changes may be measured due to source control and treatment activities in draining watershed. **Need more specific questions.**

Sargeant, D. and Ruffner, J. (2017). Bacteria Results for Nearshore Marine Areas in Puget Sound, 2010-2015: Regional Stormwater Monitoring Program. WA Dept of Ecology. https://apps.ecology.wa.gov/publications/SummaryPages/1703004.html

Current SAM Receiving Water Monitoring

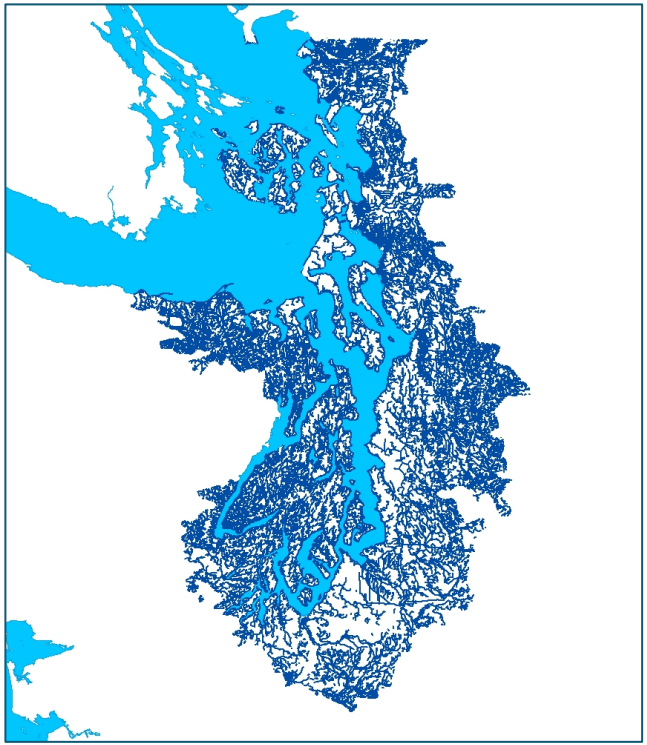


Puget Sound Monitoring Design: Process

S&T Subgroup followed year-long process to determine scientific framework

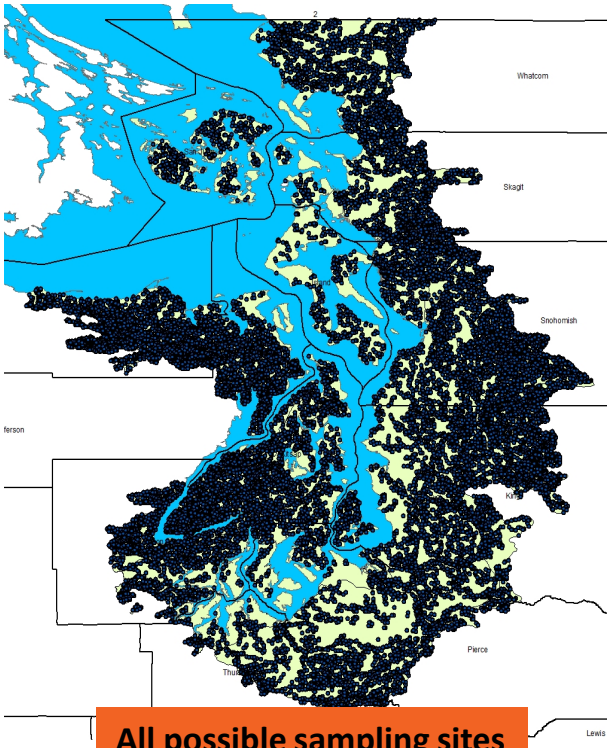
1.	Review previous studies	Jan-April 2018
2.	Eight team meetings	April-Dec 2018
3.	EPA Consultation meeting	May 2018
4.	Two-day EPA training session	June 2018
5.	Spatial design workshop	Oct 2018
6.	Joint PSEMP WG meeting	Feb 2019
7.	SAM public workshop	Feb 2019

Puget Sound Monitoring Design: Adjustments



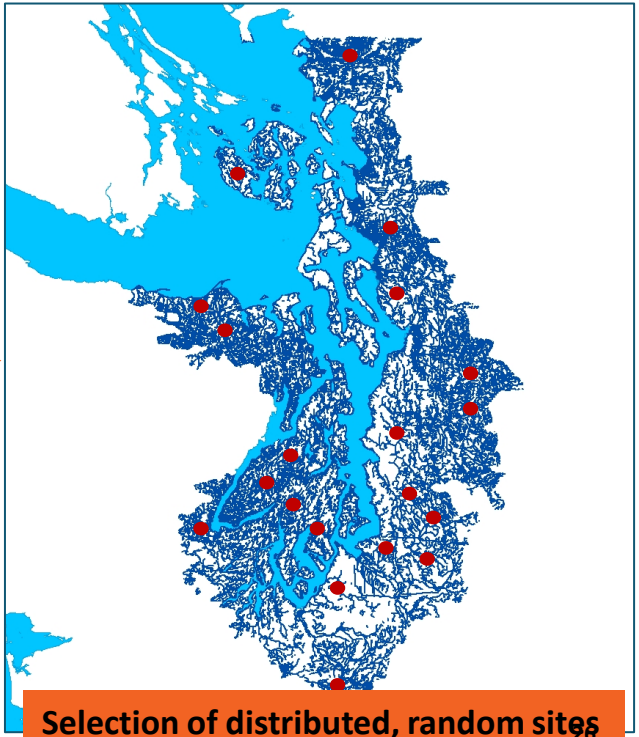
1. **Study area:** Small streams and nearshore sites selected probabilistically on updated NHD high-res, extended nearshore study area.
2. **Stratification:** Stratification of region using impervious cover (%) gradient
3. **Parameters:** Focus on integrated response to stormwater on receiving water. Drop monthly sampling. Continue continuous monitoring of stage.
4. **Frequency of Monitoring:** Streams every year, mussels every 2 years, nearshore sediment every 10 years. Combination of new sites and revisited sites to improve status and trend power.

Puget Sound Monitoring Design: Site Selection



All possible sampling sites

Generalized Random Tessellation Stratified Design (GRTS) Method



Selection of distributed, random sites

Puget Sound Monitoring Design: Sampling

Panel design

- Revisit a subset of previous sites
- Visit several new sites

Stream measurements

- Continuous water level
- Water & Sediment chemistry
- Macroinvertebrates
- Physical habitat indicators

Mussel measurements

- Metals
- PAHs
- PCBs, DDTs, and other halogenated organic compounds

Year	Past	2021	2023	2025	2027	2029	2031	2033	2035	2037	2039
Panel											
1	43	15, 18			22			11			
2			33			22			11		
3				33			22			11	
4					11			11			11
5						11			11		
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Example Panel Design for Nearshore Mussels

Lower Columbia Urban Streams

Process

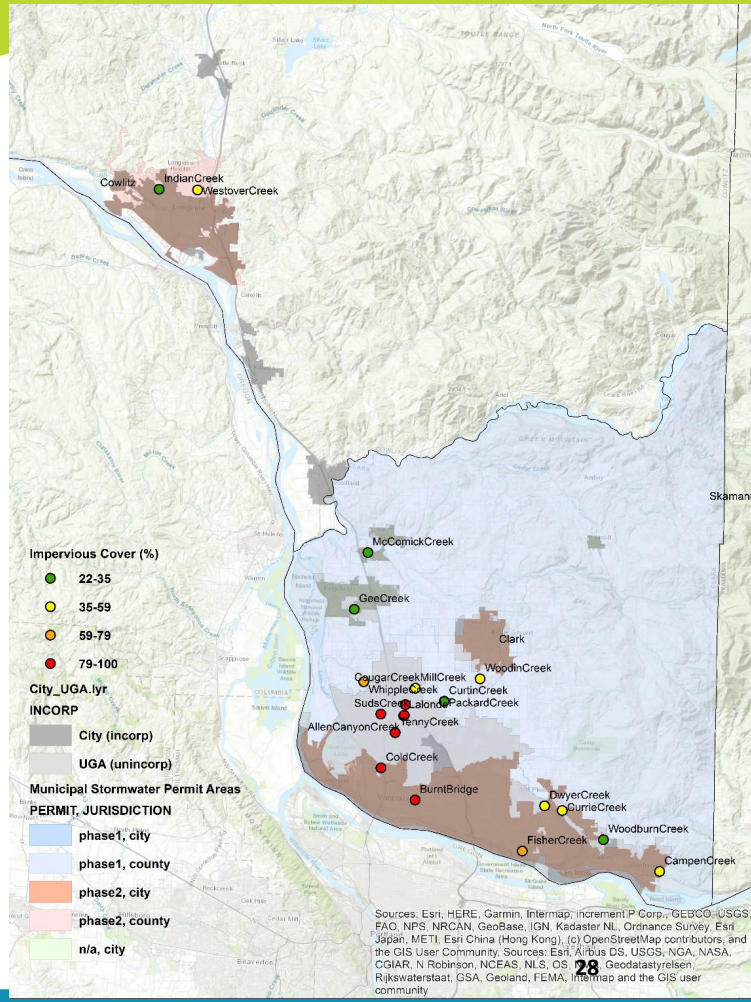
- Background information and the foundational monitoring design agreed upon in a collaborative effort by many Lower Columbia River Basin partners from 2013-2019

Sampling design

- Visit approx. 22 sites over a 5-year period
  - Five annual revisited sites
  - 3-4 additional new sites each year
- Impervious cover % range: 22-100

Stream indicators

- Continuous water level
- Water & Sediment chemistry
- Macroinvertebrates
- Physical habitat indicators



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Future Meeting Topic Ideas

- **King County's Integrated Streams Program** – a new network of 51 co-located water quality and stream bug monitoring stations designed to understand how urbanization, stormwater controls, and more affect our waterways.
- **Ecology's Watershed Health Monitoring Project** – Ecology's team has collected watershed health data statewide since 2009.
- **USEPA or USGS** – possible consult on mixed effect modeling & power analysis

S&T Subgroup Planning

Ask: 2-3 volunteers to meet 1x per month to develop agendas

Next Meeting

Which date is best?

1. Thurs Aug 21 – 1:30PM
2. Fri Aug 22 – 10AM