

## Sediment Quality in Elliott Bay, 1998 to 2007

Elliott Bay, located in Central Puget Sound near Seattle, has received pollution from human activity for more than a century. While the state has made progress here to reduce pollution from industries, sewers, and shipping, new pollutants from an array of hard-to-trace sources still threaten the bay. Polluted surface runoff (stormwater) is a leading source of pollution to Elliott Bay and all urban areas of the state. Seattle is the state's most highly populated urban area.

### A bay-wide sediment survey

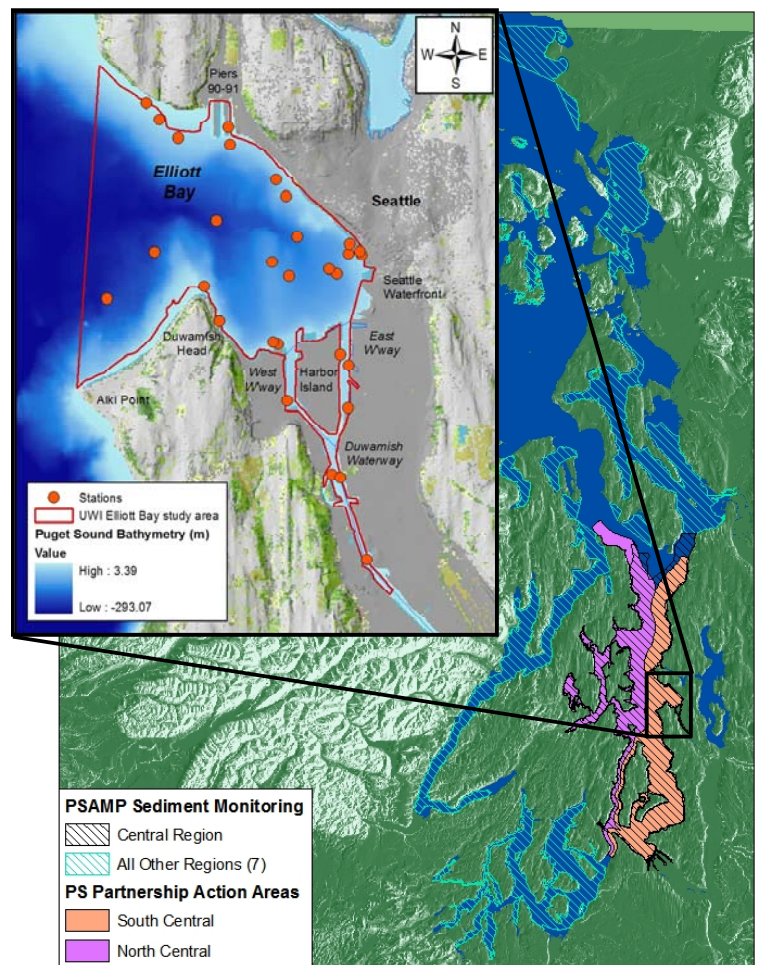
In 2007, the Washington State Department of Ecology (Ecology) conducted a bay-wide sediment quality assessment in Elliott Bay and its adjoining waterways. Scientists analyzed surface sediments from 30 stations (Figure 1) for levels of chemical contamination, sediment toxicity, and community composition of benthic (bottom-dwelling) organisms.

The 2007 data provide a "snapshot" of current sediment quality conditions for the entire Elliott Bay study area, providing a record against which scientists can compare past and future measurements.

In 1998, Ecology took similar sediment quality measurements at the same stations for the Puget Sound Assessment and Monitoring Program (PSAMP). Ecology compared these measures to the 2007 data to determine whether sediment quality has improved, declined, or remained unchanged over the past decade.

Changes provide clues as to whether environmental regulation, pollution source control, and localized cleanup efforts have created bay-wide improvements since 1998.

The 2007 data also provide a bay-scale record of sediment quality degradation in Elliott Bay and adjoining waterways. The data can be compared to sediment quality data measured at larger regional and Puget Sound-wide geographic scales.



### For more information

Valerie Partridge, Author  
360-407-7217  
[vpar461@ecy.wa.gov](mailto:vpar461@ecy.wa.gov)

Sandy Howard  
Communications Manager  
360-407-6408  
[sandy.howard@ecy.wa.gov](mailto:sandy.howard@ecy.wa.gov)

Figure 1. 30 random sediment stations sampled in Elliott Bay in 2007 and 1998, nested within the PSAMP Sediment Component Central Region. Also shown is the overlap with the marine portion of the Puget Sound Partnership's South Central Action Area.

## What does this study tell us?

- Most, but not all, sediment quality measures indicated slight improvements in sediment quality on a bay-wide scale between 1998 and 2007 (Table 1).
- As measured with Ecology's Sediment Quality Triad Index (SQTI)\*, the total area with degraded and intermediate/degraded sediment quality decreased between 1998 and 2007 from more than 30% to slightly less than 20%.
- Sediment in Elliott Bay is more degraded than non-urban areas of Puget Sound, which are less impacted by human activity.

\* *The SQTI is a multi-parameter sediment index that combines chemistry, toxicity, and benthic community data into a 4-point scale of sediment quality from high to degraded.*

## Why is this study important?

- **Generates baseline data.** Sediment quality data collected for this 2007 urban bay survey builds on the 20-year baseline of status-and-trends information established for Puget Sound by PSAMP. This baseline is essential. It has provided, and will continue to provide, environmental managers and other interested parties a means to track changes in environmental conditions over time.
- **Creates "bay-scale" effectiveness monitoring tool.** While millions of dollars have been spent on pollution source control, cleanup, and assessment of the most contaminated sediments in Elliott Bay, sediment health for the entire bay has never been quantified. This bay-scale sediment quality assessment serves as an effectiveness monitoring tool. While not tied to any one cleanup activity, this tool can be used to determine whether localized cleanups and source control efforts collectively improve conditions for Elliott Bay as a whole.
- **Provides geographic perspective.** Elliott Bay is nested within larger regional and Puget Sound-wide areas, including the Puget Sound Partnership's Action Areas. With this nested design, sediment quality can be gauged at different geographic scales, informing managers of the scope of problems and associated corrective actions.
- **Links to other ecosystem components.** In the 1980s, scientists found high rates of liver disease in fish living in urban bays of Puget Sound. Our data show that declining levels of chemicals in Elliott Bay sediment correspond with recent declines in liver disease of fish. The state is investigating the strength of these links to paint a more complete picture of their relationship to one another and to the health of the Puget Sound ecosystem.

## The importance of pollution source control, cleanup, and monitoring

While this 2007 survey indicates declining levels of some sediment contaminants in Elliott Bay, levels of other contaminants have remained the same or increased, despite efforts to clean them up. In addition, some newer types of contaminants, such as perfluorinated chemicals, were not included in this survey. Those contaminants need to be studied. Faced with a growing human population in the Puget Sound area, work is increasingly important to stop pollution at its source, clean up contaminated areas, and monitor the results to make sure our efforts are working.

Ecology conducted a similar urban bay sediment survey in Commencement Bay in 2008, and in Sinclair and Dyes Inlets (and the Bainbridge Basin) in 2009. Ecology plans to monitor Bellingham Bay, Budd Inlet, and Everett Harbor from 2010 through 2012. Re-assessment of all six urban bays will then continue on an annual, rotational basis.

Table 1. Summary of bay-scale changes from 1998 to 2007 in individual parameters measured in Elliott Bay sediment.

<p><b>Improvements</b></p> <p><b>Metals:</b> Lead, Mercury, Silver, Tin</p> <p><b>Many LPAHs<sup>1</sup></b></p> <p><b>Most HPAHs<sup>2</sup></b></p> <p><b>Most PCBs<sup>3</sup></b></p> <p><b>Sediment Toxicity</b></p> <p><b>Benthic Communities</b></p>
<p><b>No change</b></p> <p><b>Metals:</b> Arsenic, Cadmium, Chromium, Copper, Nickel</p> <p><b>Some LPAHs<sup>1</sup></b></p> <p><b>HPAHs<sup>2</sup>:</b> Chrysene, Perylene</p>
<p><b>Deterioration</b></p> <p><b>Metals:</b> Zinc</p> <p><b>LPAHs<sup>1</sup>:</b> Acenaphthylene, Retene</p> <p><b>Bis(2-ethylhexyl)phthalate<sup>4</sup></b></p>

<sup>1</sup> Low Molecular Weight Polycyclic Aromatic Hydrocarbons

<sup>2</sup> High Molecular Weight Polycyclic Aromatic Hydrocarbons

<sup>3</sup> Polychlorinated Biphenyls

<sup>4</sup> A common plasticizer; also known as DEHP