

GREEN RIVER WATER REPORT SUMMARY

Evaluating PCBs in the Green River Watershed: Supporting the Duwamish Superfund Site Cleanup

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The purpose of this study was to evaluate water quality in the Green River Watershed upstream of the Lower Duwamish Waterway Superfund Site. The lower five miles of the Duwamish River sediment is contaminated with polychlorinated biphenyls, or PCBs, which came from many sources, including industries along the waterway and stormwater runoff. Most of the pollution is historical, from times before modern pollution controls were in place.

PCBs are mixtures of man-made organic chemicals that were used in hundreds of industrial and commercial applications. They were used from approximately 1929 until 1979, when the federal government banned PCB manufacturing and use. Although their current commercial use is restricted in the U.S., they continue to be a common environmental contaminant because they do not break down easily. As PCBs enter a river, lake or marine water, they can attach to the sediment (or mud) at the bottom of the waterbody and can accumulate in fish or other animals that live in the water. People who eat lots of fish or shellfish contaminated with PCBs could have a higher chance of health effects such as cancer, weakened immune systems, and developmental effects in young children.

Study objectives and methods

This study was designed to evaluate PCB concentrations in water collected from the Green River and four major tributaries: Newaukum Creek, Soos Creek, Mill Creek and the Black River (**Figure 4**). These tributary basins range

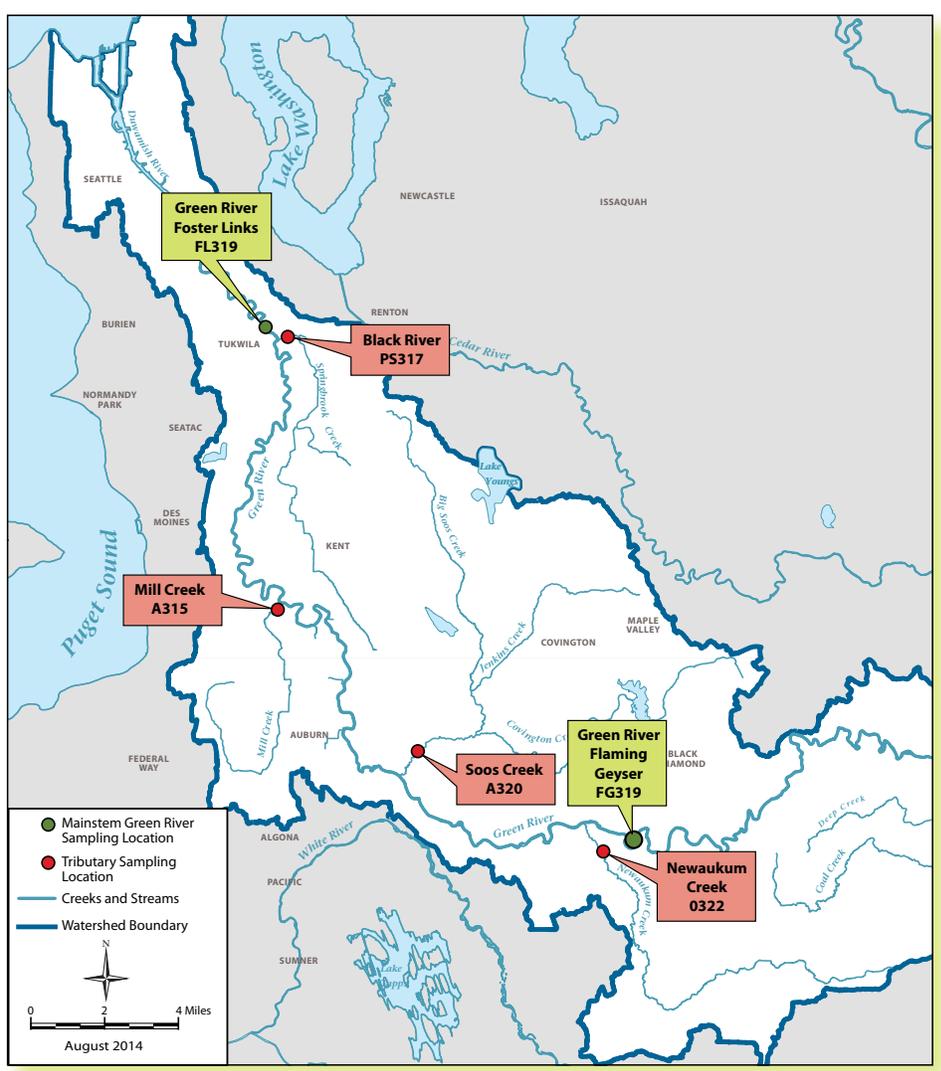


FIGURE 4. Green River Watershed Surface Water Sampling Locations.

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in land use from rural to urban, with an increasing mix of commercial/industrial and residential uses as one moves downstream. The two Green River mainstem sampling locations were at Flaming Geyser State Park (upriver of the major tributaries being sampled), and at Foster Links Golf Course (downstream of the tributaries). At each location, there were three samples collected during the summer dry season and six samples collected during the rainy or wet season. Each sample was a composite of multiple sample aliquots collected over a 12-24 hour period.

This study was designed to answer the following two questions:

1. How do the relative contributions of PCBs differ between dry season/baseflow and wet season/ storm conditions?
2. What are the relative spatial differences in PCB concentrations in the Green River and its major tributaries?

The data will help King County understand upstream sources of PCBs to the Lower Duwamish Waterway Superfund site. This water quality study by King County is just one of many efforts the County, the City of Seattle and Washington Department of Ecology are undertaking to understand and reduce sources of PCBs to the Lower Duwamish Waterway.

Results

PCBs were detected at relatively low concentrations in all samples. Total PCB concentrations during baseflow ranged from 0.0668 to 4.80 nanograms per liter (ng/L)¹ with an average concentration across all sites of 0.442 ng/L. Total PCB concentrations during storm events ranged from 0.173 to 3.09 ng/L with an average concentration across all sites of 0.804 ng/L. The concentrations are well below Washington state water quality criteria for the protection of aquatic life (14.0 ng/L) but some are above the criteria based on protection of human health (0.170 ng/L), which is a level meant to protect people who eat fish from the river, not a level for drinking the water.

Median² concentrations during storm events were higher than baseflow medians at all sites. At the three most

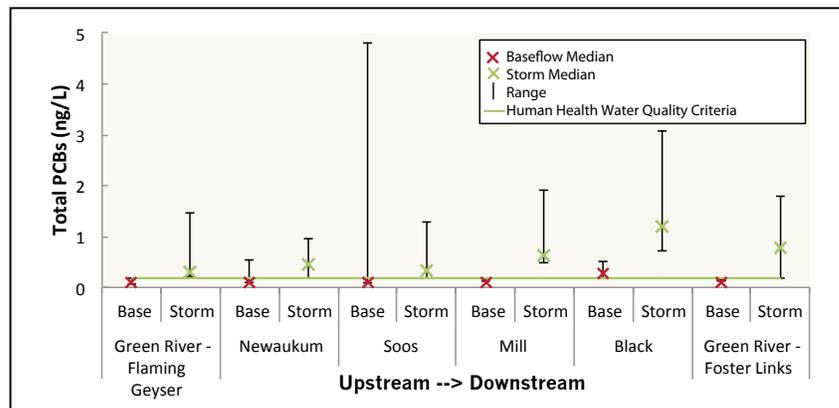


FIGURE 5. Total PCB concentrations by location and for baseflow and storm flow conditions.

downstream sites – Mill Creek, Black River and Green River Foster Links – all storm event PCB concentrations were higher than baseflow PCBs (Figure 5). PCB concentrations were statistically higher during storm events than during baseflow when the data were grouped by Green River mainstem sites or by the three tributaries, Newaukum, Soos and Mill creeks. This means we saw higher concentrations overall during storm conditions than during summer baseflow conditions. This suggests more PCBs are entering the river during periods of rainfall than during periods without rainfall.

During both baseflow and storm events, the lowest median PCB concentrations were detected at the most upstream location, Green River – Flaming Geyser, and the highest median PCB concentrations were detected at the most downstream tributary, the Black River; however, there were no statistical differences between sampling locations. This tells us that while we can see a difference in median concentrations, the variability in the concentrations of PCBs at each location is too high to result in true difference between the locations.

The downstream Green River mainstem location includes more developed land use than the upstream location, which we might expect to be associated with higher PCB concentrations. When we compared PCB concentrations at the two sites, they were generally within the same range of each other. It is possible more samples collected over a longer time period could tease out potential differences in PCB concentrations or perhaps the large volume of flow from upstream is diluting the influence of PCBs from local runoff at the downstream location.

¹ This is the same as parts per trillion or one part in 1,000,000,000,000.

² The median represents the middle value of the dataset.

PCB concentrations found in this study are comparable to previous sampling efforts in the lower Green River and to a study in the Snohomish River and Puyallup River watersheds.

Currently, we are analyzing additional surface water data from the upper reaches of the Green River, both above and below the Howard Hanson Dam, to characterize PCB concentrations in areas further removed from development and urbanization and therefore less impacted by their pollution sources. The new sampling sites above Howard Hanson Dam will allow evaluations of water quality in forested land use where PCB sources should be largely from atmospheric transport, including global transport of PCBs.

The full Lower Duwamish Waterway Source Control: Green River Watershed Surface Water Data Report can be found at: www.kingcounty.gov/environment/wastewater/Duwamish-waterway/PreventingPollution/PollutionSources.aspx

Contributors to King County's SciFYI

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Carly Greyell (Western Washington University, B.S.) is a recent addition to the King County Science and Technical Support Section and is part of the Toxicology and Contaminant Assessment group. She has been supporting many of the Lower Duwamish source control projects and will be involved in ongoing toxics monitoring and new projects assessing the effectiveness of stormwater treatment.



Debra Williston

Debra Williston is an environmental scientist within the King County Science and Technical Support Section with 25 years of experience in conducting water and sediment quality assessments and ecological risk assessments with a focus on contaminated sediment sites over the last 12 years. She is a member of the technical team conducting remedial investigations and feasibility studies for both the Lower Duwamish Waterway and East Waterway Superfund sites. She also provides technical and project management support for various source control investigations that support the Superfund sites.



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