Sediment Transport to the Lower Duwamish Waterway

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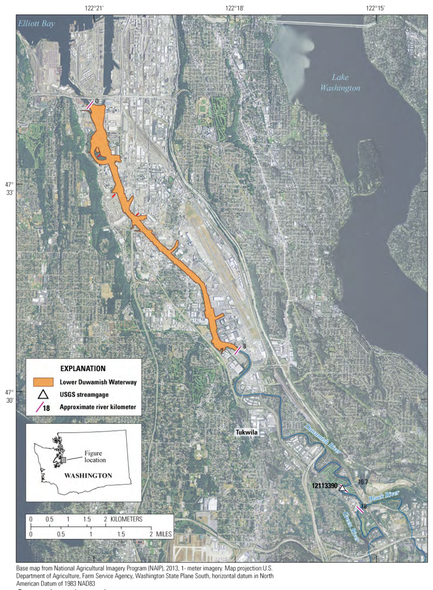
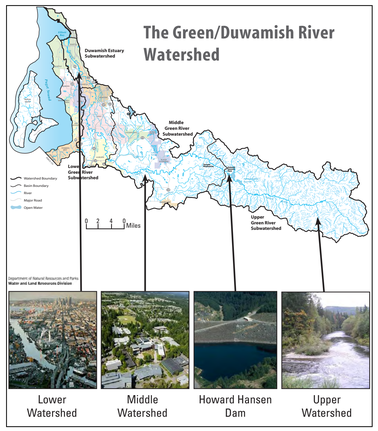
Introduction

The Green-Duwamish River transports watershed-derived sediment to the Lower Duwamish Waterway Superfund site near Seattle, Washington. Understanding the amount and timing of sediment transported by the river, as well as contaminants associated with the sediment, is essential to the bed sediment cleanup process. The diverse watershed can be divided into three source types; lower watershed – industrial/urban, middle watershed – suburban/agricultural, and upper watershed – forested.



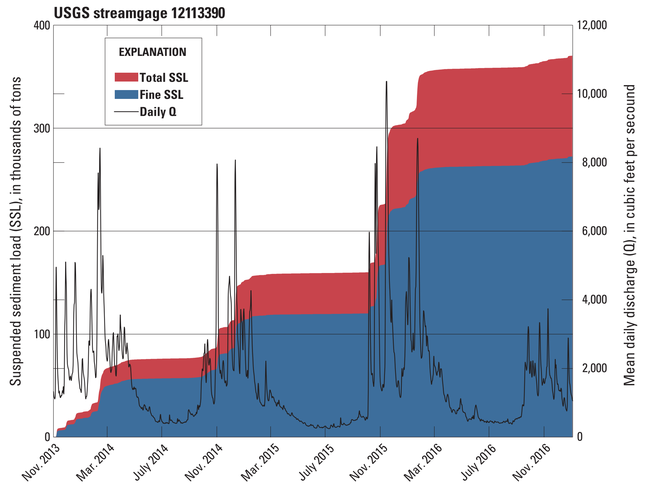
Base map from National Agricultural Imagery Program (NAIP), 2013, 1-meter imagery. Map projection U.S. Department of Agriculture, Farm Service Agency, Washington State Plane South, horizontal datum in North American Datum of 1983 NAD83

Overview location map

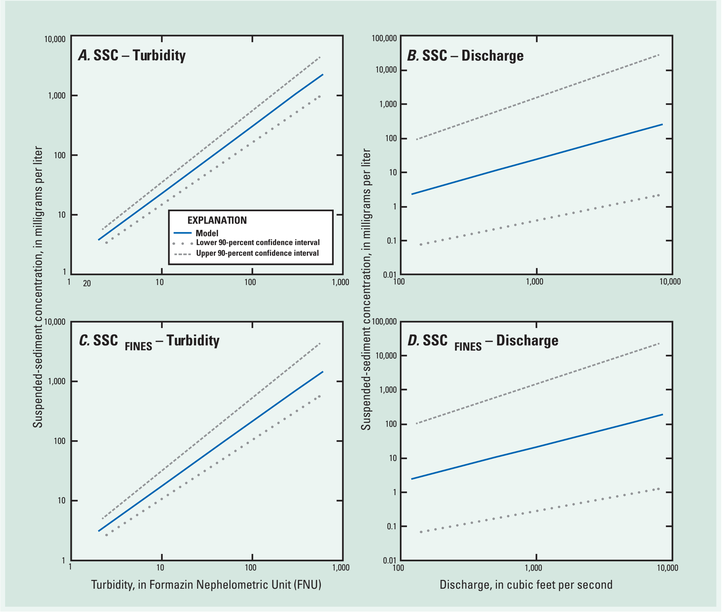


The river reverses flow direction (streamgage records flow in the upstream direction) more than 10 miles from the mouth due to tidal influence.

Turbidity (clarity or cloudiness of water, primary surrogate for suspended-sediment concentration) data were coupled with measured suspended-sediment concentration (particles of sediment suspended in water column, measured in milligrams per liter of water) to compute a record of suspended sediment concentrations. Discharge data were coupled with concentration data to compute total and fine particle suspended-sediment loads (mass per unit of time, that is concentration multiplied by river flow).

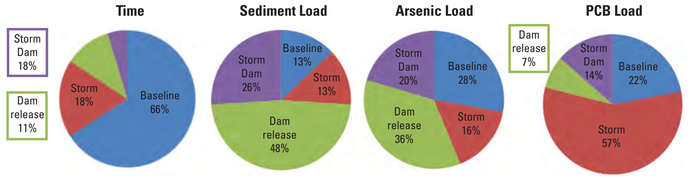


Graph of cumulative suspended-sediment load and mean daily discharge measured at U.S. Geological Survey streamgage 12113390 – Duwamish River at Golf Course at Tukwila, WA. The 2014–16 average annual suspended-sediment load (total SSL) computed was 117,246 tons, of which 73.5 percent or (86,191 tons) was fine particle (less than 0.0625 millimeter in diameter) suspended sediment (fine SSL). More than 90 percent of total loads were transported during the winter months from large releases from the Howard Hanson Dam and/or storm events.



Graphs showing comparison of the statistical confidence levels in the models developed to compute suspended-sediment concentration. Results indicate that turbidity is a far superior surrogate than discharge. Suspended-sediment concentration (SSC) regression model plots with associated upper and lower 90-percent confidence bounds. (*A*) log10 SSC versus log10 Turbidity; (*B*) log10 SSC versus log10 Discharge; (*C*) log10 SSC_{FINES} versus log10 Turbidity; (*D*) log10 SSC_{FINES} versus log10 Discharge. SSC_{FINES}, suspended-sediment concentration of particles less than 0.0625 mm in diameter.

Chemicals such as metals and polychlorinated biphenyls (PCBs) were measured on suspended sediment using a novel field technique that separates suspended sediment from large volumes of river water using a continuous-flow centrifuge. (https://www.youtube.com/watch?v=SUoIoyK3JIM)



The pie charts show that most of the time the river is in a "baseline" condition, when sediment transport is low, and events that occur over a relatively short period of time make up the majority of sediment and chemical loads. However, the most chemical transport does not always coincide with the most sediment transport (dam releases).

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