

## Columbia Slough Sediment Investigation

The Columbia Slough area in Portland, Oregon has a long history of farming and industrial use. Investigations have found chemicals associated with these uses, such as pesticides and polychlorinated biphenyl, commonly known as PCBs, in Columbia Slough sediments above acceptable limits for bioaccumulation in fish. The Department of Environmental Quality received a grant from the Environmental Protection Agency to investigate slough sediments. Information collected was combined with prior sediment work in the Columbia Slough to refine DEQ's understanding of bioaccumulation, the accumulation of organic chemicals in an organism.

This information is also helpful in understanding the potential harm to fish, birds, mammals and people that eat fish from the slough.

This fact sheet describes the investigation and evaluation of the data generated from the study.

### Background

In 2005, the DEQ issued a Record of Decision for the Columbia Slough that described the framework for cleanup of sediment contamination in the slough. The three primary components of the sediment cleanup approach are:

- Pollutant source reduction
- Specific site cleanup
- Long-term monitoring

There are currently over 30 active cleanup projects in the Columbia Slough watershed. These projects are in various stages of investigation or cleanup. Investigation and cleanup of wide spread contaminated sediments is difficult to implement using a site-specific approach because numerous private, commercial and industrial facilities have discharged stormwater to the slough. The EPA grant provides resources to answer questions on a wider scale.

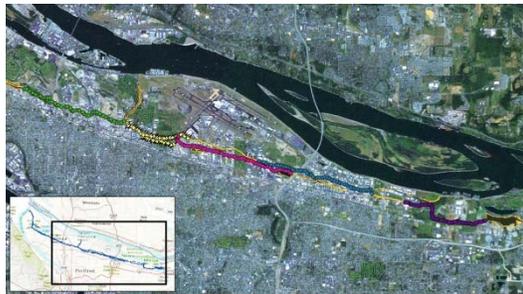
The objectives of work conducted with the EPA grant are:

- Determine average concentrations of contaminants in slough sediment and develop updated estimates of baseline concentrations in the sampled segments
- Develop predictive relationships between sediment and fish tissue

- Validate DEQ's bioaccumulation guidance using data specific to the Columbia Slough.

### Investigation area

The investigation area includes three segments: Lower Middle Columbia Slough and Buffalo Slough, Upper Middle Columbia Slough and Upper Columbia Slough sampled in summer 2011. Lower Columbia Slough and Whitaker Slough segments were previously sampled in 2009 and winter 2011, respectively and are included in the data analysis. Each segment is approximately two to three miles in length. Existing data generally indicate that PCB levels decrease while moving upstream and pesticides increase while moving upstream in the basin.



*Columbia Slough investigation area*

The general sampling strategy included two sample designs: an incremental sampling strategy to determine average sediment concentrations throughout each segment and targeted sampling in locations of suspected contamination. Incremental sampling provides a reliable, defensible, and cost-effective method to determine average concentrations within the area. Field activities were carried out in accordance with the Sampling and Analysis Plan, *Columbia Slough Sediment Investigation; ECSI#1283* (DEQ, 2011).

Incremental sampling involved collecting 50 sediment samples spread throughout each segment and using them to create three composite samples which were analyzed for all contaminants of concern.

Targeted samples, consisting of five to eight samples composited into one sample, were located in sediment areas with suspected elevated concentrations.



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*Sediment sample*

Targeted samples also were used for bioaccumulation tests conducted in the lab. Analysts placed worms in the sediment samples and measured contaminant uptake in worm tissue.

Sediments were analyzed for PCBs and pesticides that bioaccumulate.

### **Results**

The incremental sampling data for each segment shows low variability between the three replicates, indicating that the values provide representative average concentrations for each of the Slough segments. DEQ considers the mean value to reflect baseline conditions for the segments.



*Collecting sediment samples*

Sampling in each segment found PCB concentrations similar to previous Slough baseline value. DDT values were below previous baseline values, suggesting DDT is breaking down into the byproducts DDD, DDE. A table is provided at the end of the fact sheet.

Except for Fairview Lake, targeted samples had higher concentrations than baseline values as they were located in the vicinity of likely source areas.

Bioaccumulation assays indicated accumulation of PCBs and pesticides into invertebrate worm

tissue is consistent with levels that would be expected based on theoretical relationships.

Data modeling was performed with Columbia River and Columbia Slough PCB sediment results to understand PCB 'profiles' in the slough sediment. Four different profiles were found. One PCB profile consists of a complex mixture of high molecular weight congeners suggesting historical releases that have degraded. A second PCB profile comprising a very small fraction of the sediments is suspected of being from atmospheric deposition. Two PCB profiles were likely from local industrial sources and stormwater inputs.

A 90 percent or more reduction in PCB concentrations would be required to reduce risks to acceptable levels. Given the apparent widespread nature of PCBs, which were historically present in many different materials and the recirculation of PCBs in the urban environment, achieving the desired reductions may be challenging. The work will require long-term monitoring and improved understanding of current pollution sources as well as the potential for residual PCB contamination in sediment to bioaccumulate.

Efforts to identify PCB sources and associated release mechanisms, including stormwater and local point sources, could help focus cleanup resources and ultimately help to reduce contaminants in fish and the birds, mammals and people that eat fish from the slough.

DEQ is currently working with property owners and the City of Portland to identify and remove specific sources of PCBs and pesticides and monitor effectiveness in the Columbia Slough basin.



*Middle Columbia Slough*

**For more information:**

For the full report on this study go to [www.deq.state.or.us/lq/cu/NWR/ColumbiaSlough/](http://www.deq.state.or.us/lq/cu/NWR/ColumbiaSlough/)

DEQ welcomes questions and comments on the Columbia Slough Sediment Project. For more information contact DEQ Project Manager, Jennifer Sutter, 503-229-6148 or [sutter.jennifer@deq.state.or.us](mailto:sutter.jennifer@deq.state.or.us).

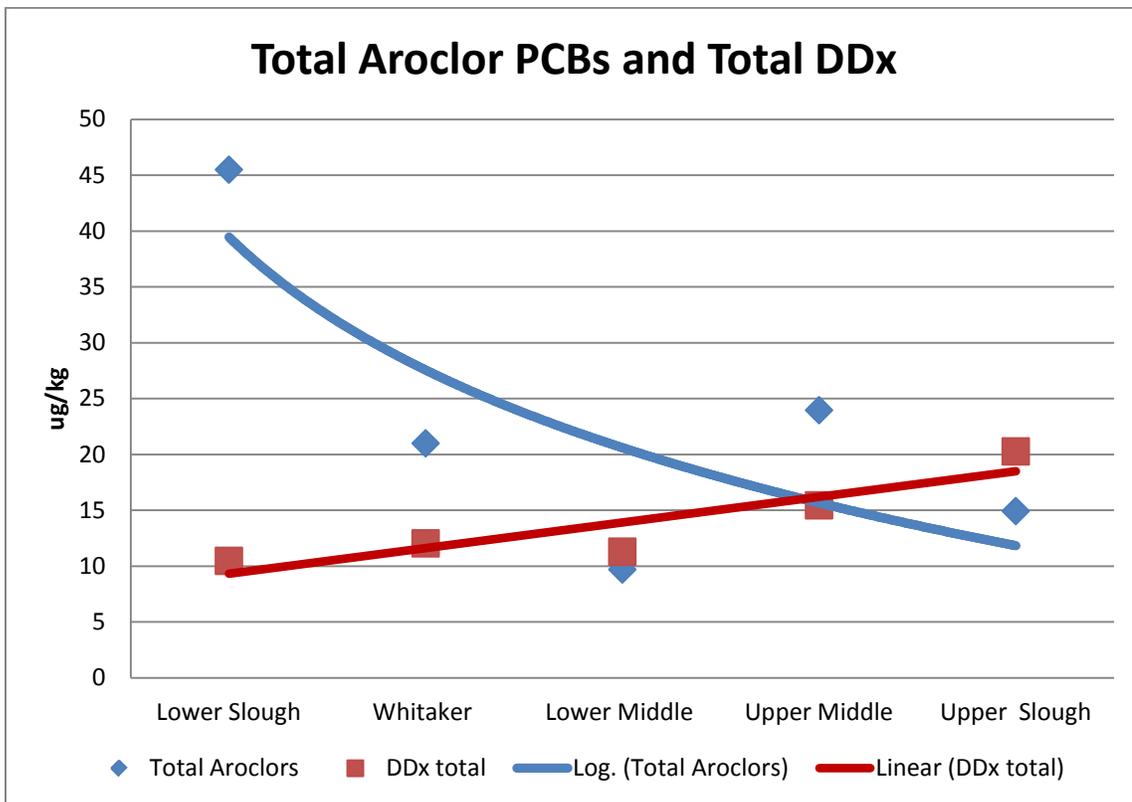
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*Table: Columbia Slough segments-average sediment concentrations*

<b>Organics (ug/kg)</b>	<b>Average Sediment Concentration Summary</b>					<b>Previous Slough baseline values</b>
	<b>Lower Slough</b>	<b>Whitaker Slough</b>	<b>Lower Middle</b>	<b>Upper Middle</b>	<b>Upper Slough</b>	<b>Columbia Slough</b>
PCB Aroclor 1260	18.7	21	5 u	5	7	24
Total PCB Aroclors	45	21	9	24	15	10
DDD*	3.7	4.5	3.6	5.3	6.2	6.1
DDE*	6.3	6.6	6.8	9.2	13.2	7
DDT*	0.47	0.95	0.91	0.98	0.84	2.5

\* Pesticide; u-under detection limit



*Total Aroclor PCB and Total DDx pesticide concentrations in Columbia Slough sediments*