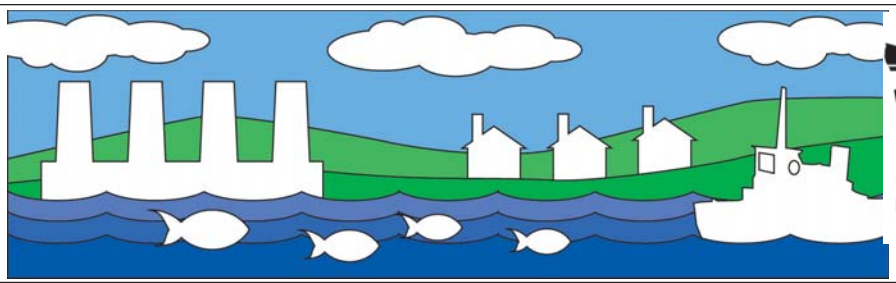

Lower Duwamish Waterway Superfund Site, Seattle, Washington

January 2005

Cleanups are now being planned for contaminated sediment, or mud, at Terminal 117 and Slip 4 on the Lower Duwamish Waterway. There are several ways to clean up contaminated sediment from these two areas. This fact sheet focuses on some options for removing and disposing of the contaminated sediment. This information is being provided to answer questions the public has asked and to help the public evaluate specific cleanup proposals later this year.

How Is Contaminated Sediment Cleaned Up?

Contaminated sediment can be dug up, dredged, or covered with a cap. Sediment that is removed requires disposal, treatment, or both treatment and disposal.

What Are the Dredging Options?

Sediment close to shore can be dug up using a backhoe operated from the land. Sediment farther from shore can be removed using a dredge. The types of dredges that can be used vary depending on conditions such as the water depth, tides, the sediment composition, and the disposal method. The two most common types are mechanical and hydraulic.

Mechanical dredges dig out the sediment and place it on a barge for transport away from the site. For soft sediment, the most effective mechanical dredge is a closed "environmental" bucket. This type of dredge minimizes the sediment that falls back into the water as the bucket is raised.

If the sediment is made of hard clay or compacted sand, or contains a lot of debris, a digging bucket, also called a clamshell bucket, is needed to cut and remove the sediment. Clamshell buckets can be operated to release as little sediment as environmental buckets release. Environmentally safe operation of clamshell buckets requires engineering controls, such as carefully matching the type of bucket to the site conditions and using a slow dredging speed.

(See photos, page 2)

Background

The U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) are coordinating the cleanup of the Lower Duwamish Waterway Superfund site. The Lower Duwamish Waterway Group (King County, the City of Seattle, the Port of Seattle, and The Boeing Company) is conducting the studies that will lead to cleanup of the waterway under a legal agreement with EPA and Ecology.

Four areas of the waterway have been selected for "early actions" to clean up contaminated sediment. Early actions have been partially completed in one area and are being developed for three more, including Terminal 117 and Slip 4.

Mechanical dredges dig up contaminated sediment and place it on barges that transport it for disposal, treatment, or treatment and disposal.

Hydraulic dredges use rotating blades or water jets to cut the sediment, and pumps that suck up the sediment along with a large amount of water. The water is removed from the sediment by a process called dewatering. Then the water must be tested and treated before it is returned to the waterway.

Hydraulic dredges cut contaminated sediment from the river bottom and vacuum it up, along with large volumes of water.

A hydraulic dredge is typically used when the sediment to be removed is very loose and soft. This type of dredge does not work as well when the sediment is hard clay or contains debris. In most cases, hydraulic dredging releases less sediment than mechanical dredging. However, it has the disadvantage of requiring an area nearby large enough for dewatering the dredged sediment.

Is Dredging Safe for the Environment?

Dredging releases some contaminants into the environment, no matter what method is used. EPA and Ecology believe that the long-term benefits of removing contaminants from the river outweigh short-term risks from a much smaller amount of released contaminants.

In recent years, great advances have been made in environmental dredging techniques to minimize the release of sediment and contaminants from a dredge. The skill and experience of the dredge operator and the type of sediment and debris affect the amount of sediment released. EPA and Ecology require daily monitoring of the water in the vicinity of the dredge. If water quality standards are not met, the agencies require the dredger to make adjustments, such as stopping or slowing down the operation.

What Happens to the Dredged Sediment?

Following dredging, the sediment is transported by barge or pipeline to a nearby site in the water (in-water) or on land (upland). The sediment can be disposed of or treated at the site, or transferred to trucks or rail cars for disposal or treatment at a more distant site.

(continued)

What Happens to . . . Sediment? *(continued)*

Three types of sites are used for disposal of dredged contaminated sediment or of materials remaining after the sediment is treated:

- In-water disposal site.
- New upland landfill built at or near the site.
- Existing licensed upland landfill built to contain contaminated materials.

In-water disposal means placing sediment in a natural or manmade hole under water and then capping the sediment with clean material. In-water disposal has been used successfully elsewhere in Puget Sound. However, it can take years to meet the environmental permitting requirements to build an in-water disposal site.

An **upland landfill** can be built near the contaminated site to contain the dredged sediment. The cost of this option depends on the amount of sediment to be disposed of and the availability of vacant land near the site.

Recent dredging projects in the Puget Sound area have disposed of contaminated sediment in a **licensed upland landfill** in Eastern Washington. The dredged sediment is placed in trucks or specially designed rail car containers that are sealed to prevent spills during transport to the landfill.

Such a landfill has natural features and engineering controls that ensure that contaminants do not leak out the bottom or sides. The natural features include little rainfall and up to 1,500 feet (including over 300 feet of clay) between the bottom of the landfill and the closest groundwater source. The clay acts as a barrier between the groundwater and the landfill.

The engineering controls include lining the bottom of the landfill, not allowing highly contaminated hazardous materials into the landfill, daily covering of contaminated sediment with clean soils, collecting and treating any groundwater generated in the landfill, and monitoring the air and groundwater around the landfill.

Barges transport mechanically dredged sediment to the shore, where it can be loaded onto trucks or rail cars for transport to landfills or treatment facilities.

This option has been selected for several of the sediment cleanups in the Puget Sound area, including recent cleanups at Harbor Island and on the Lower Duwamish Waterway. Costs have ranged from $40 to $70 per ton, including transportation, handling, and disposal.

Regional landfills use natural and engineering barriers to contain contaminants for thousands of years.
(Drawing courtesy of Rabanco)

What about Treatment?

Treatment can remove contaminants from sediment, destroy contaminants, or change them in some way to reduce the risk they pose to human health or the environment. Some treatment processes can be done in place, but most in-place technologies are still in the experimental stage. Usually, the contaminated sediment is removed and treated elsewhere.

Generally, treatment is most cost effective when the sediment contains very high levels of contaminants or the volume is many thousands of cubic yards. When possible, the goal of treatment is to remove the contaminants so completely that the sediment can be used as clean fill. Often such complete removal of contaminants is not feasible, so the treated sediment still requires disposal in a landfill or in-water disposal site. Sometimes treatment is necessary to meet requirements for disposal in a landfill.

Examples of treatment technologies for contaminated sediment include these:

- Washing clean sand from the more toxic sediment, so that the sand is available for reuse and the remaining contaminated sediment can be sent for disposal. Chemicals can be added to enhance removal of the contaminants from the sediment.

- Heating sediment to high temperatures to destroy contaminants by burning them (incineration) or vaporizing and collecting them (thermal desorption).

- Adding cement or other substances to the sediment to keep contaminants from leaching out (solidification/stabilization).

Treatment has been selected for a few contaminated Superfund sediment sites in the United States, including one in the Puget Sound area. The most often selected treatment was solidification/stabilization. At these sites, contaminant concentrations were far higher than those found at Slip 4 and Terminal 117. The cost of treatment can range from $150 to more than $1000 per ton, including transportation, handling, and disposal of treated residuals.

Dredging, disposal, and treatment technologies will all be considered for the contaminated Slip 4 and Terminal 117 sediment.

What Happens Next?

Engineering Evaluation/Cost Analysis reports will be prepared for Terminal 117 and Slip 4 this year. These reports will discuss the proposed boundaries of the cleanup areas. They will also evaluate cleanup approaches specific to the site conditions and propose cleanup plans. The Port of Seattle and the City of Seattle are preparing the report for Terminal 117. The City and King County are preparing the report for Slip 4.

Each report will be available to the public for a thirty-day comment period. EPA will announce the public comment periods, which are expected to be within about the next six months. Following public comment, EPA and Ecology will select the cleanup technologies to be used at these sites based on several criteria, including protection of human health and the environment, technical feasibility, cost, and public comment.

In addition, a **Candidate Technologies Memorandum** is being prepared to evaluate cleanup technologies for the long-term cleanup of the entire Lower Duwamish Waterway site. This evaluation will be available for informal public review later this winter.

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How Can I Get More Information?

Visit EPA's website:

http://www.epa.gov/r10earth/
Click on Index, then "L," and then "Lower Duwamish Waterway Site."
Click on "Related Links" to find guides for the public on dredging and disposal.

Call one of our information repositories for an appointment to review documents:

Georgetown Gospel Chapel, 6606 Carleton Avenue South, Seattle, WA, 206-767-3207
EPA Region 10 Records Center, 1200 Sixth Avenue, Seattle, WA, 206-553-4494
Washington State Department of Ecology, 3190 160th Avenue SE, Bellevue, WA, 425-649-7190

Call or e-mail one of these contacts:

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Si desea hablar con alguien que habla español, llame a Pamela Emerson, EPA, 206-553-1287.

Alternative formats are available. For reasonable accommodation, please call Cindy Schuster. TTY users, please call the Federal Relay Service at 1-800-877-8339 and give the operator Cindy Schuster's phone number.

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