EPA United States Environmental Protection Agency

Summary of Study for Lower Duwamish Waterway: Enhanced Natural Recovery and Activated Carbon

Region 10

December 2021

In 2014, the U.S. Environmental Protection Agency and the Department of Ecology asked the Lower Duwamish Waterway Group to conduct a study. The aim was to find out whether adding activated carbon to Enhanced Natural Recovery material would help meet the Lower Duwamish Waterway cleanup goals faster than Enhanced Natural Recovery alone. Activated carbon is a common material used in household water filters. It binds up contaminants like polychlorinated biphenyls, or PCBs, a contaminant in the Lower Duwamish Waterway. Enhanced Natural Recovery involves placing clean sand on top of contaminated sediment to speed cleanup. Read on to learn more about the study and its findings.

About the study

One technology being used in the Lower Duwamish Waterway sediment cleanup is Enhanced Natural Recovery.

Natural Recovery	Enhanced Natural Recovery
• Cleaner sediments from upstream naturally deposit on the river bottom over time. • These cleaner sediments mix with contaminated sediment to reduce contamination levels.	• Contractors add a foot or less of clean sand (or sand and gravel) on top of contaminated sediment. • This speeds up or enhances the natural recovery process.

Compared to dredging or a thick sediment cap, natural recovery and Enhanced Natural Recovery have less impact on the animals that live in sediment.

Lower Duwamish Waterway Group – LDWG – designed a study to see if adding activated carbon to Enhanced Natural Recovery material would better prevent PCBs from entering the river's food chain. Studies at other sites have shown the benefit of mixing activated carbon directly into the contaminated sediments or adding a carbon layer to sediment caps. The benefit of adding activated carbon to Enhanced Natural Recovery material had not been studied previously.

Activated carbon ➡ (with quarters to show scale)

How was the study conducted?

In 2016, scientists measured PCBs in sediment at three study areas, called plots, in the LDW: intertidal, subtidal, and scour (where boats and barges tend to be active). See map on page 5. In 2016 and 2017, LDWG contractors placed layers of sand or sand and gravel, and the same material with activated carbon mixed in, on these plots.

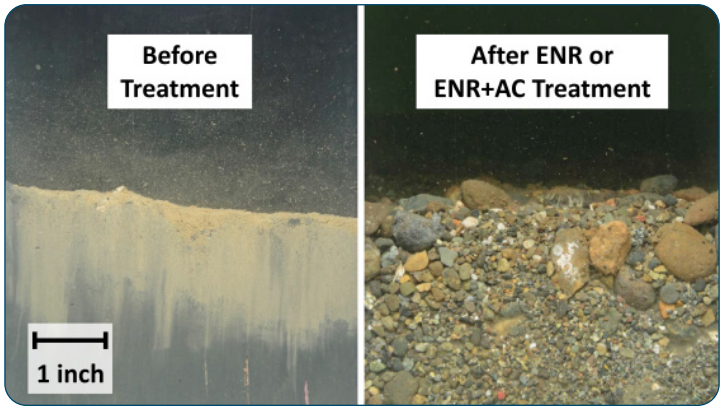
After construction, scientists monitored the plots for three years: 2018, 2019, and 2020.

Each year, scientists measured PCBs in the ENR and ENR+AC material and in water between particles of the material. In addition, a laboratory study using ENR and ENR+AC material compared the PCB levels in worms and clams that lived in the test sediment. This monitoring compared how well ENR and ENR+AC answered the study questions, discussed below.

Contractors using a barge-mounted excavator to place study material in the Lower Duwamish Waterway

Was ENR+AC successfully placed on the river bottom, and did the ENR and ENR+AC material stay in place?

Yes, the material was successfully placed on the river bottom and it did stay in place. After the contractors placed the ENR + AC material, scientists collected samples from the test plots. Some activated carbon was lost during placement, as expected.



Side-view photos of sediment before (left) and after (right) the addition of ENR or ENR+AC material

After the material was placed, scientists monitored the plots annually for three years. They took measurements to confirm the ENR material and the activated carbon remained where placed.

The data show:

- The sand and gravel stayed where they were placed.
- Some activated carbon may have been lost from the top few inches of materials. Enough AC remained that scientists expect it would reduce the amount of PCBs entering the river's food chain.
- In one plot, barge activities at a nearby docking area disturbed a portion of the materials. This high level of disturbance is not expected in most other locations of the LDW. Despite the disturbance, sand and activated carbon were still present.

Scientist sampling ENR + AC material

Did ENR and ENR+AC reduce the bioavailability of PCBs?

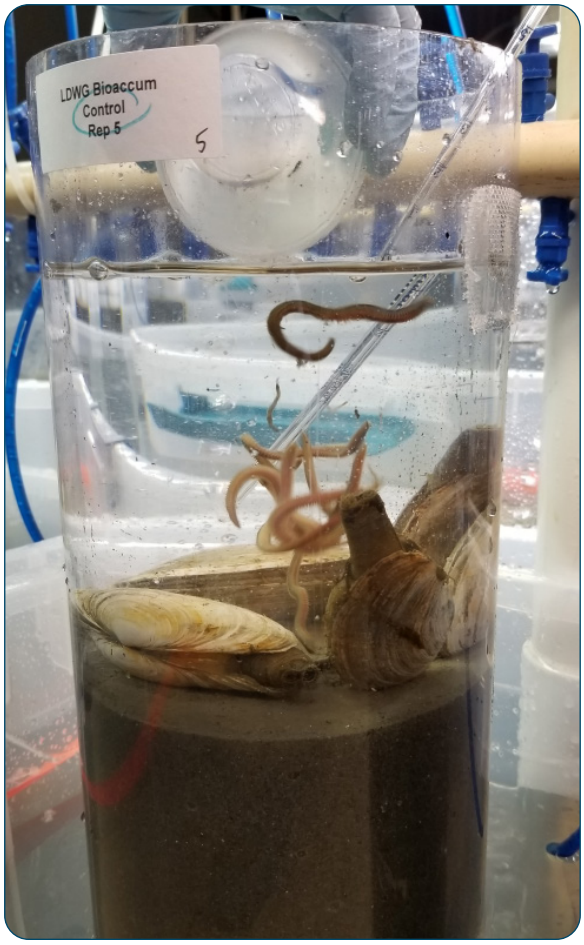
Yes. The data show that the bioavailability of PCBs was reduced by 90% or more in most plots with ENR or ENR+AC. This means that fewer PCBs could enter the food chain.

Bioavailability is the ability for contamination to enter the food chain.

Did activated carbon further reduce PCB bioavailability?

The study did not show measurable differences between ENR and ENR+AC plots, except in the intertidal plot. In the intertidal plot, scientists measured a difference, but it was minor. ENR by itself was very effective in reducing the amount of PCBs available to enter the food chain.

Scientist collecting samples of sediment from study plots



Adding aquatic worms and clams to test the ENR and ENR+AC material in the laboratory

Is adding Activated Carbon to ENR safe for animals that live in sediment?

Yes. A 2020 field study of the three plots found that the ecological health of the aquatic animals that are now living in the ENR+AC material was the same as that of the animals living in the ENR material with no activated carbon. ENR and ENR+AC materials were collected in 2020 from one plot and brought to a laboratory for more testing. Scientists added aquatic worms and clams to the treated sediment to test their response. After one month, the worms and clams living in the ENR+AC material were just as healthy as those living in the ENR material with no activated carbon. Both the laboratory and field studies show that the type and amount of activated carbon applied in this project is not harmful to LDW aquatic animals.

Should Activated Carbon be used to enhance ENR in the Lower Duwamish Waterway?

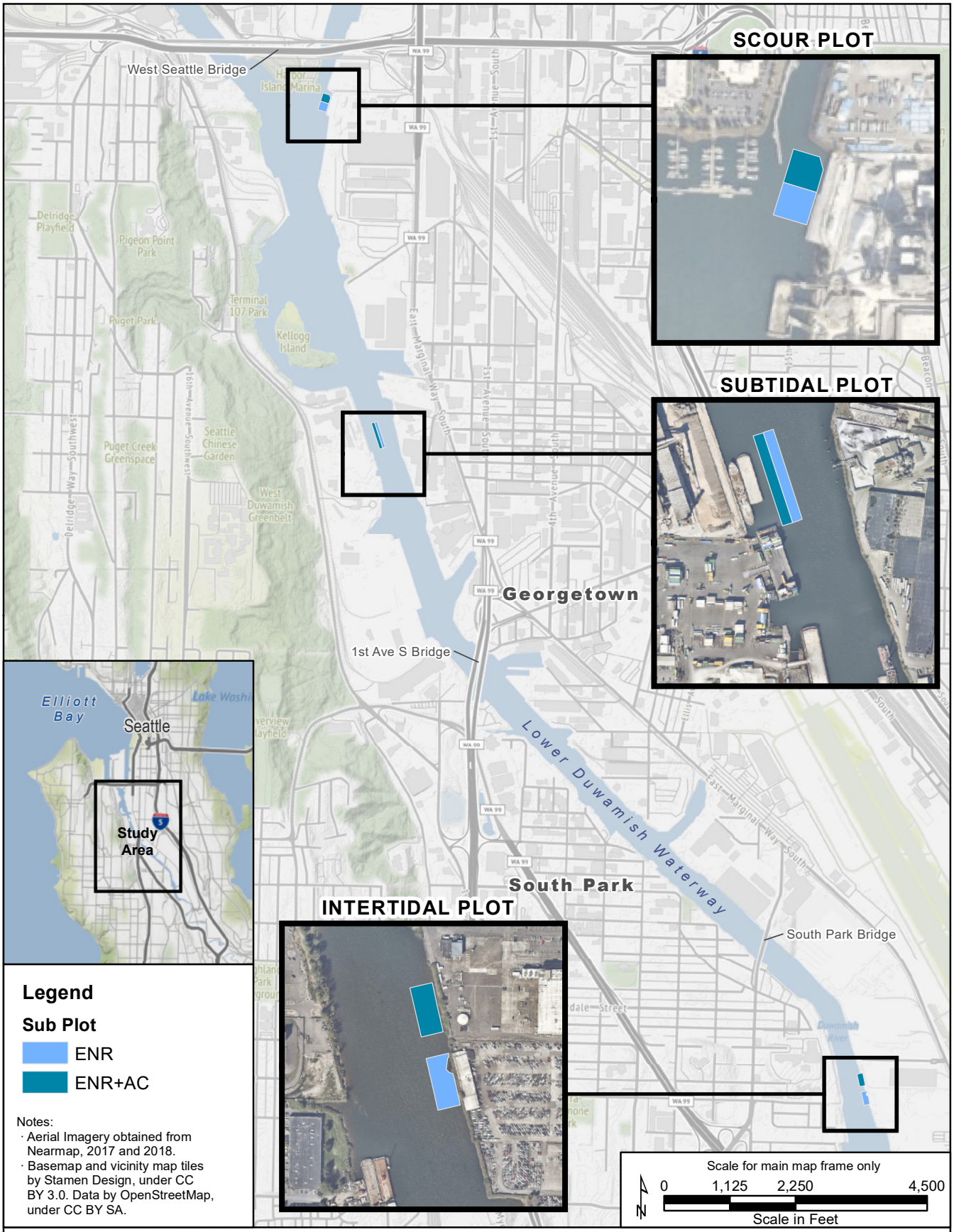
The cleanup plan for the LDW uses ENR in areas where PCB levels are generally lower. Dredging and capping is required in more contaminated areas.

Based on this pilot study, EPA and Ecology have decided that while there is no harm, there is also no clear benefit in adding activated carbon to ENR in the LDW. The study also confirms ENR effectively reduces contaminant bioavailability without the need to add activated carbon.

Will Activated Carbon be used during the cleanup?

Activated carbon is an effective and commonly-used treatment technology in sediment cleanups for contaminants like PCBs. In the LDW cleanup, activated carbon may be used as a layer in sediment caps or where waterway structures (like docks) make dredging or capping contaminated sediment difficult. These uses of activated carbon in LDW will be considered during the design of the sediment cleanup.

Intertidal study plot at low tide (ENR sand and gravel in foreground)



Enhanced Natural Recovery/ Activated Carbon Pilot Study Plots and Vicinity Map

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For more Information

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A full report of the study is available on the LDWG online library (https://ldwg.org/project-library) under the "Enhanced Natural Recovery / Activated Carbon Pilot Study (AOC Amendment 2)" link.

For information on the **U.S. Environmental Protection Agency's work** in the Lower Duwamish Waterway, please visit: epa.gov/superfund/lower-duwamish.

To receive **regular updates** on EPA's cleanup work, please contact Kay Morrison (morrison.kay@epa.gov) to subscribe to the **Duwamish cleanup listserv**.

For information on **Washington Department of Ecology's work** in the Lower Duwamish Waterway, please visit: ecology.wa.gov/Spills-Cleanup/Contamination-cleanup/Cleanup-sites/Toxic-cleanup-sites/Lower-Duwamish-Waterway.

For information on the **Community Advisory Group**, please contact the Duwamish River Community Coalition/ Technical Advisory Group at duwamishcleanup.org or contact@duwamishcleanup.org • (206) 954-0218.

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