

## **Appendix D**

### **Summary of Capping Projects**

## Appendix D Summary of Contaminated Sediment Capping Projects

Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness (feet)	Cap Material	Year Constructed	Performance	Comments
<i>Puget Sound</i>							
Duwamish Waterway Seattle, Washington	Heavy metals, PCBs		1-3	Sand (4,000 cy)	1984	<ul style="list-style-type: none"> <li>No chemical migration</li> <li>No erosion of cap</li> </ul>	Monitoring as recent as 1996 showed cap remains effective and stable. Split-hull dump barge placed sand over relocated sediments (CAD site) in 70' water.
One Tree Island Olympia, Washington	Heavy metals, PAHs		4	Sand	1987	<ul style="list-style-type: none"> <li>No chemical migration</li> <li>No erosion of cap</li> </ul>	Last monitoring occurred in 1989 showed that sediment contaminants were contained.
St Paul Waterway Tacoma, Washington	Phenols, PAHs, dioxins		2-12	Coarse sand	1988	<ul style="list-style-type: none"> <li>No chemical migration</li> <li>Cap within specifications</li> </ul>	Some redistribution of cap materials has occurred, but overall remains >1.5 m (4.9'). C. californicus found in sediments, but never >1 m (3.3').
Pier 51 Ferry Terminal Seattle, Washington	Mercury, PAHs, PCBs		1.5	Coarse sand (4 acres) ( <i>in situ</i> )	1989	<ul style="list-style-type: none"> <li>No chemical migration</li> <li>Cap within specifications</li> <li>Recolonization observed</li> </ul>	As recent as 1994, cap thickness remained within design specifications. While benthic infauna have recolonized the cap, there is not indication of cap breach due to bioturbation.
Denny Way CSO Seattle, Washington	Heavy metals, PAHs, PCBs	Water depth 18-50 ft	2-3	Sand (3 acres)	1990	<ul style="list-style-type: none"> <li>No data available</li> </ul>	Cores taken in 1994 show that while cap surface chemistry shows signs of recontamination, there is no migration of isolated chemicals through the cap.
Piers 53-55 CSO Seattle, Washington	Heavy metals, PAHs		1.3-2.6	Sand (4.5 acres) ( <i>in situ</i> )	1992	<ul style="list-style-type: none"> <li>No chemical migration</li> <li>Cap stable, and increased by 15 cm (6") of new deposition</li> </ul>	Pre-cap infaunal communities were destroyed in the rapid burial associated with cap construction.
Pier 64 Seattle, Washington	Heavy metals, PAHs, phthalates, dibenzofuran		0.5-1.5	Sand	1994	<ul style="list-style-type: none"> <li>Some loss of cap thickness</li> <li>Reduction in surface chemical concentrations</li> </ul>	Thin-layer capping was used to enhance natural recovery and to reduce resuspension of contaminants during pile driving.
GP lagoon Bellingham, Washington ( <i>insitu</i> )	Mercury	Shallow intertidal lagoon	3	Sand	2001	<ul style="list-style-type: none"> <li>No chemical migration at 3-months</li> <li>Cap successfully placed</li> </ul>	Ongoing monitoring
East Eagle Harbor/Wyckoff Bainbridge Island, Washington	Mercury, PAHs		1-3	Sand (275,000 cy)	1994	<ul style="list-style-type: none"> <li>No chemical migration</li> <li>Cap erosion in ferry lanes</li> <li>Some chemicals observed in cap</li> </ul>	Cap erosion measured within first year of monitoring only in area proximal to heavily-used Washington ferry lane. Chemicals also observed in sediment traps. Ongoing monitoring.
West Eagle Harbor/Wyckoff Bainbridge Island, Washington ( <i>in situ</i> )	Mercury, PAHs	500 acre site	Thin cap 0.5' over 6 acres and Thick cap 3' over 0.6 acres	Sand (22,600 tons for thin cap and 7,400 tons for thick cap)	Partial dredge and cap 1997	<ul style="list-style-type: none"> <li>No chemical migration</li> </ul>	To date, post-verification surface sediment samples have met the cleanup criteria established for the project. Ongoing monitoring.

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<i>California and Oregon</i>							
PSWH Los Angeles, California	Heavy metals, PAHs		15	Sand	1995	<ul style="list-style-type: none"> <li>No data to date</li> </ul>	Overall effective cap was >15'. This was not a function of design, but rather a function of the low contaminated-to-clean sediment volume.
Convair Lagoon San Diego, California	PCBs	5.7 acre cap in 10 acre site; water depth 10- 18 ft	2' of sand over 1' rock	Sand over crushed rock	1998	<ul style="list-style-type: none"> <li>No chemical migration</li> <li>Cap was successfully placed in very shallow water</li> <li>Some chemicals observed in cap</li> </ul>	Ongoing monitoring for 20 to 50 years including diver inspection, cap coring, biological monitoring
CAD Long Beach, California	Heavy metals, PAHs		5	Sand	planned, but not constructed	<ul style="list-style-type: none"> <li>No data to date</li> </ul>	Design cap thickness was a function of deepest depth for prevention of bioturbation by thalassinid burrowing shrimp.
McCormick and Baxter Portland, Oregon	Heavy metals, PAHs	15 acres of nearshore sediments and soils	NA	Sand	planned, but not constructed	<ul style="list-style-type: none"> <li>No data to date</li> </ul>	Long-term monitoring, OMMP, and institutional controls were also specified
<i>Great Lakes</i>							
Sheboygan Falls Wisconsin (pilot)	PCBs	9 hotspots totalling 1,200 sq yds	1 ft of coarse material and upper geotextile over lower geotextile	Composite	1992	<ul style="list-style-type: none"> <li>No monitoring data</li> </ul>	Composite armored cap required as sediments were located in high-energy river environment. Gabions placed around the corners for anchoring. Additional coarse material placed into voids/gaps.
Sheboygan River/Harbor Wisconsin	PCBs		unknown	Armored stone composite	1989–1990	<ul style="list-style-type: none"> <li>Undetermined cap effectiveness</li> <li>Some erosion of fine-grained</li> </ul>	Demonstration bench-scale project.
Areas C and D Manistique, Michigan	PCBs		2.7	Composite	planned, but not implemented (site remediation was dredging)	<ul style="list-style-type: none"> <li>Project is unbuilt</li> </ul>	Composite cap over a 17-acre site that includes armoring and geotextiles.
Manistique Capping Project Wisconsin	PCBs		40-mil (0.1')	HDPE	1993	<ul style="list-style-type: none"> <li>Physical inspection of the temporary cap approximately 1 year after installation showed cap was physically intact and most anchors still in place</li> </ul>	A 240' by 100' HDPE temporary cap was anchored by 38 2 ton concrete blocks placed around the perimeter of the cap. This temporary cap was installed to prevent erosion of contaminated sediments within a river hotspot with elevated surface concentrations.
Hamilton Harbor Ontario, Canada	PAHs		1.6	Sand (2.5 acres) ( <i>in situ</i> )	1995	<ul style="list-style-type: none"> <li>No monitoring data</li> </ul>	Cap recently completed.

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<i>New England/New York</i>							
Stamford-New Haven-N New Haven, Connecticut	Metals, PAHs		1.6	Sand	1978	• No chemical migration	Cores collected in 1990.
Stamford-New Haven-S New Haven, Connecticut	Metals, PAHs		1.6	Silt	1978	• No chemical migration	Cores collected in 1990.
New York Mud Dump Disposal Site New York	Metals (from multiple harbor		unknown	Sand (12 million cy)	1980	• No chemical migration	Cores taken in 1993 (3.5 years later) showed cap integrity over relocated sediments in 80' of water.
Mill-Quinnipiac River Connecticut	Metals, PAHs		1.6	Silt	1981	• Required additional cap	Cores collected in 1991.
Norwalk, Connecticut	Metals, PAHs		1.6	Silt	1981	• No problems	Routine monitoring.
Central Long Island Sound Disposal Site (CLIS) New York	Multiple harbor sources		unknown	Sand	1979–1983	• Some cores uniform structure with low-level chemicals • Some cores no chemical migration • Some slumping	Extensive coring study at multiple mounds showed cap stable at many locations. Poor recolonization in many areas.
Cap Site 1 Connecticut	Metals, PAHs		1.6	Silt	1983	• No chemical migration	Cores collected in 1990.
Cap Site 2 Connecticut	Metals, PAHs		1.6	Sand	1983	• Required additional cap	Cores collected in 1990.
Experimental Mud Dam New York	Metals, PAHs		3.3	Sand	1983	• No chemical migration	Cores collected in 1990.
New Haven Harbor New Haven, Connecticut	Metals, PAHs		1.6	Silt	1993	• No chemical migration	Extensive coring study.
Port Newark/Elizabeth New York	Metals, PAHs		5.3	Sand	1993	• No chemical migration	Extensive coring study.
52 Smaller Projects New England	Metals, PAHs		1.6	Silt	1980–1995	• No chemical migration	Routine monitoring.

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<i>International Projects</i>							
Rotterdam Harbor Netherlands	Oils	Water depth 5 to 12 m	2–3	Silt/Clay sediments	1984	• No available monitoring data	As pollution of groundwater was a potential concern, the site was lined with clay prior to sediment disposal and capping.
Hiroshima Bay Japan		Water depth 21 m	5.3	Sand	1983	• No available data	

**References:**

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