

Thea Foss Waterway Remediation Project

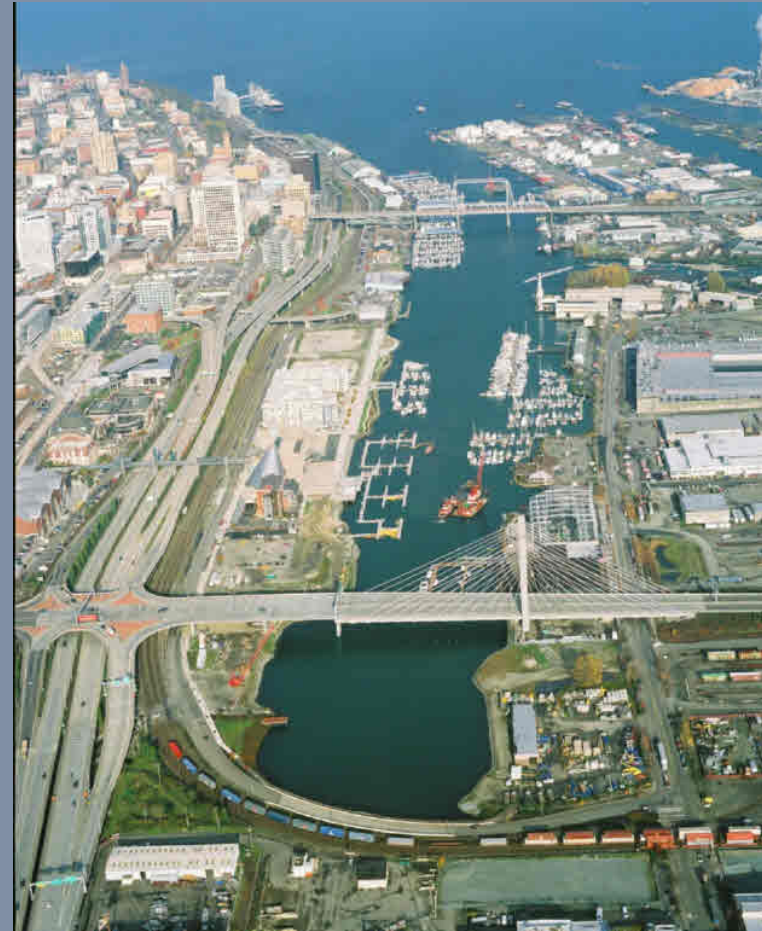
An Example of the Risk-Based, Multi-Technology Approach to Contaminated Sediment Management

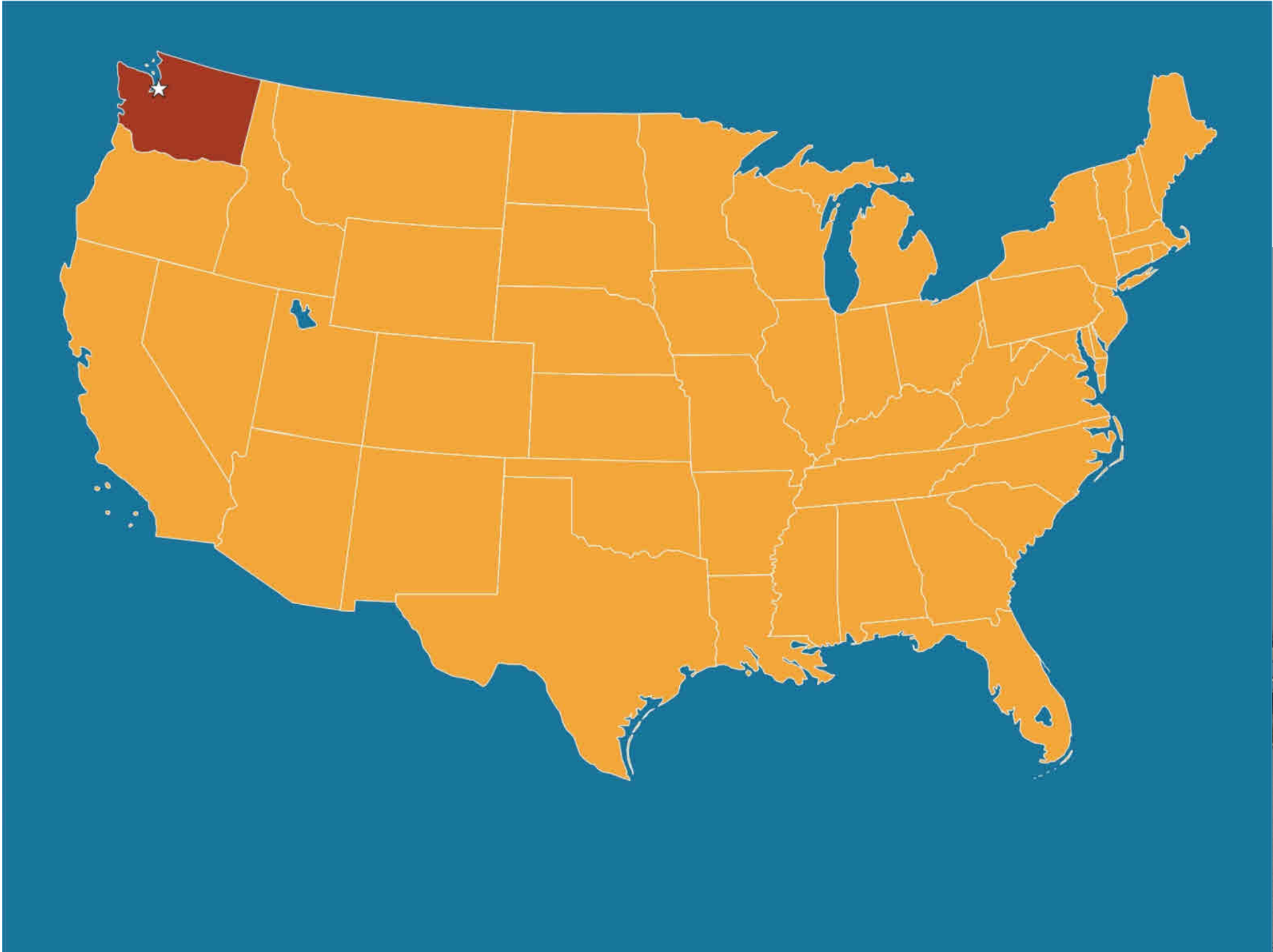


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ARCADIS**
- **Mary Henley, PE, Project Manager
City of Tacoma**

Thea Foss Waterway, Washington, USA

- Waterway received storm drainage and direct discharges: oils, tars, PAHs, phthalates, PCBs
- Multi-user waterway with Extensive redevelopment underway
- Extensive industrial and recreational use
- Risk-based remedial design incorporated source controls, natural recovery, capping, dredging, confined disposal, and habitat mitigation



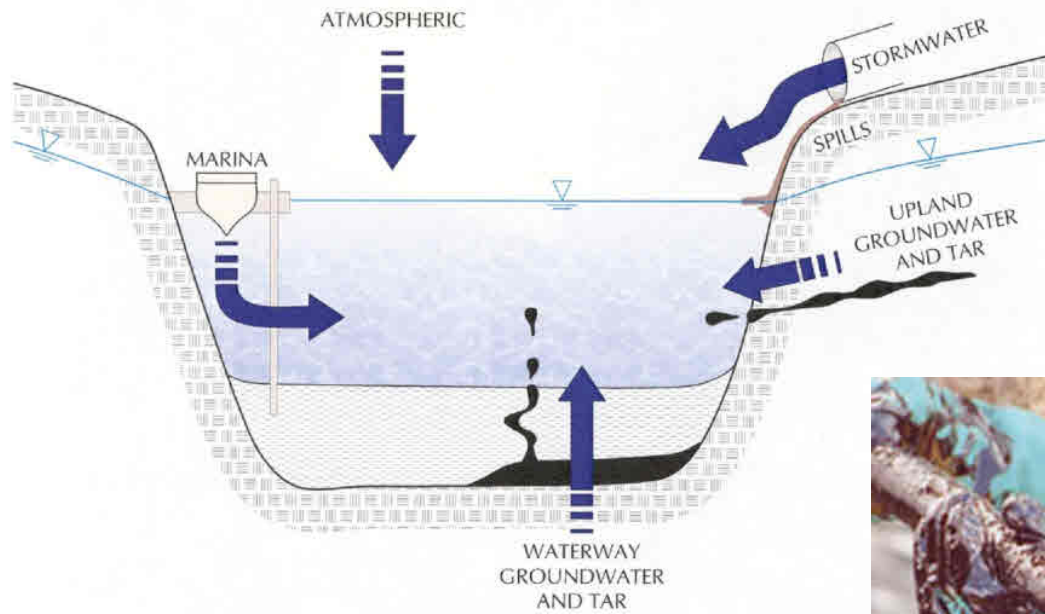




100 Years of Use (and abuse)



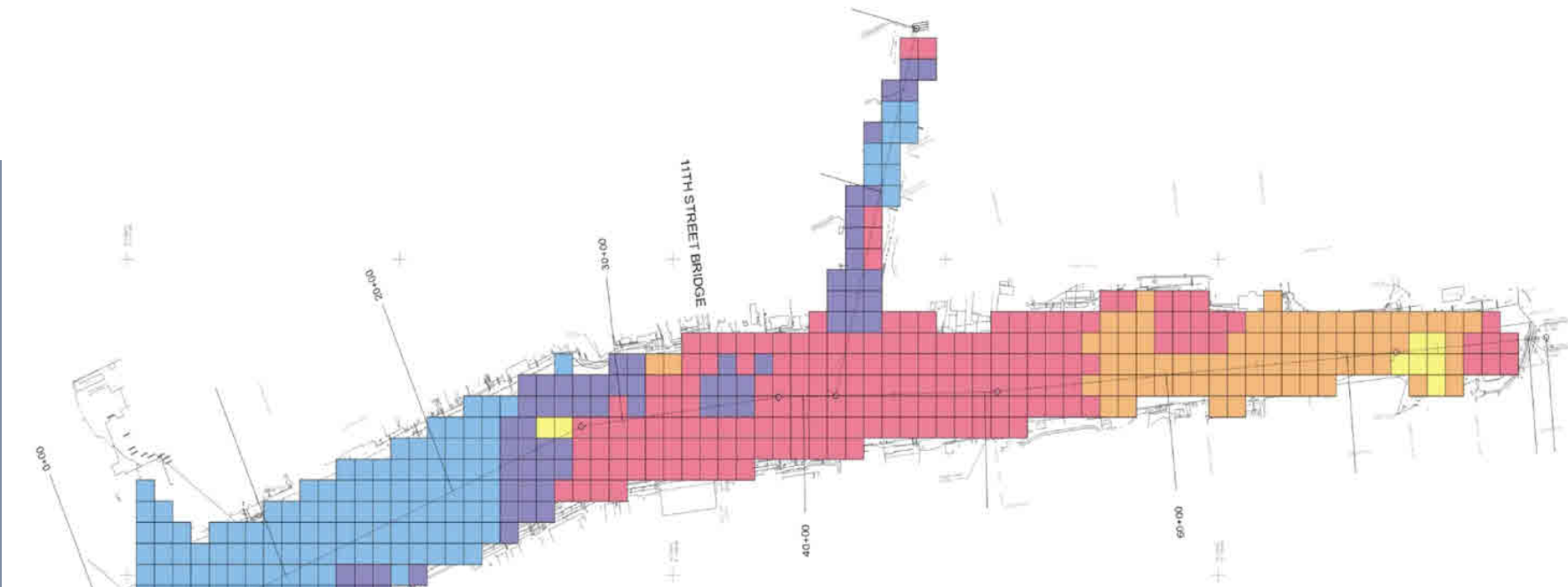
POTENTIAL POLLUTANT SOURCES THEA FOSS WATERWAY



What were we
dealing with?

- PAHs
- Phthalates
- PCBs
- Pesticides
- Metals
- Phenols



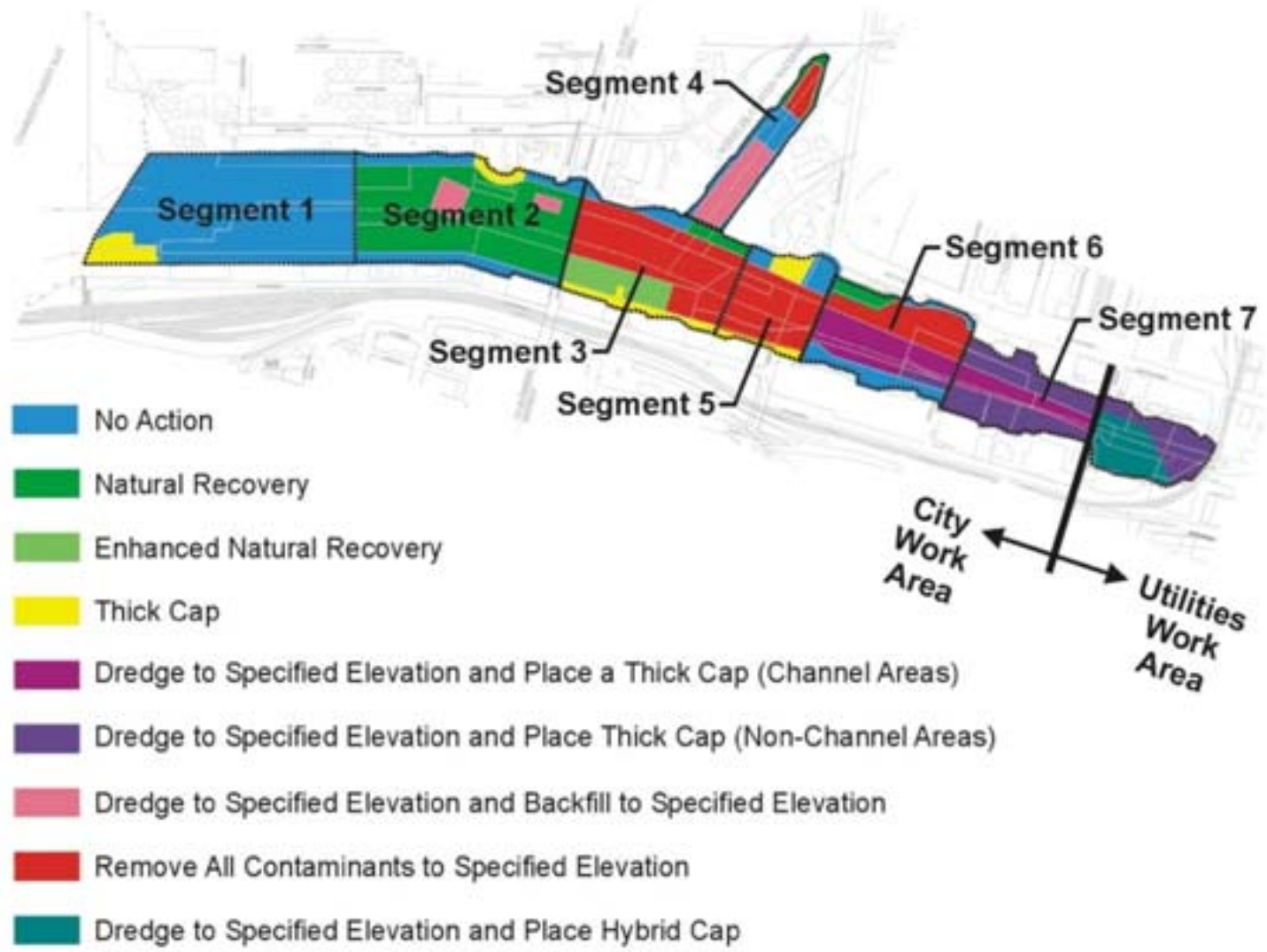


- 100' x 100' Kriged Block
- Kriged Estimate of Composite Enrichment Ratio**
- 0 to 1
- 1 to 2
- 2 to 5
- 5 to 10
- >10

* Maximum enrichment ratio of pyrene, phenanthrene, bis(2-ethylhexyl) phthalate, mercury, and PCBs (key Constituents)

Final Remedy and Disposal Site(s)

- Sequential Risk Management applied to the Thea Foss Waterway –
 - dredging (47 acres – 525,000 cubic yards),
 - capping (30 acres – 225,000 cubic yards),
 - enhanced natural attenuation (4 acres),
 - natural attenuation (21 acres), and
 - no action (37 acres)
- Disposal Option – St. Paul Waterway Nearshore Confined Disposal Facility (CDF)



Design Challenges in the Thea Foss Waterway

- Proximity of residential property and consequent concern about noise, odor, and other aesthetic issues
- Construction Impacts on waterfront structures and marinas
- Coordinating with State-led Cleanup and Development Projects – Foss Development and the Esplanade Project
- Outreach to property owners

Cleaning up the Waterway

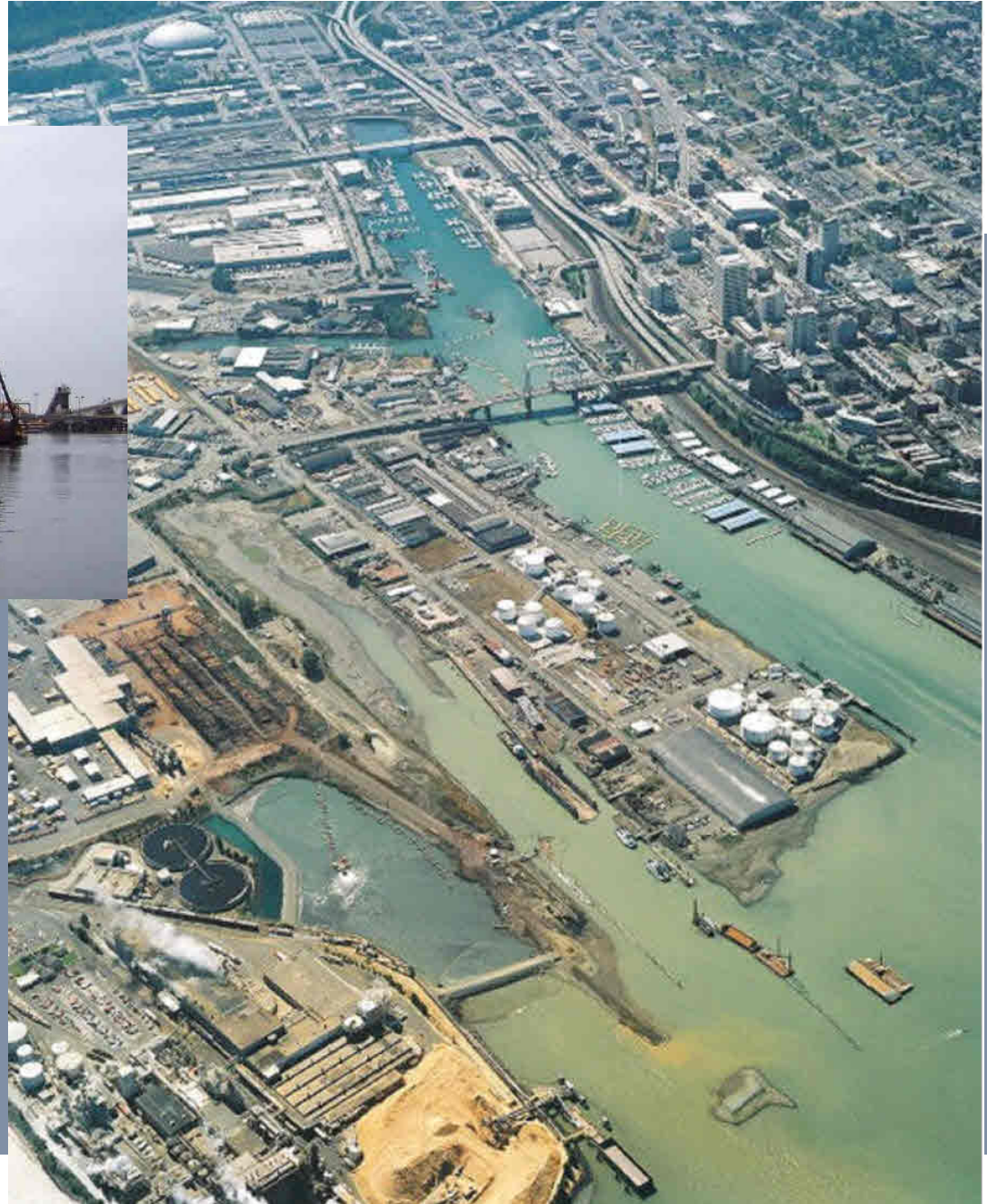


St. Paul Waterway CDF

- 12-acre waterway owned by Simpson
- Original depth to -20 ft. MLLW
- Dredged to -60 ft. MLLW for a capacity of 520,000 CY
- Construction of containment & offset berms
- Capped with 9-13 feet of clean material



St. Paul CDF



St. Paul CDF nearing Completion



Marinas

- Construction of a new marina
- Removal and replacement of 5 private marinas
- Orchestrated over 850 commercial and recreational boat moves





Remedial Actions

- 24 separate Remediation Areas (RAs)
- 60 acres of contaminated sediments
- 7 types of remedial actions
 - Dredge to clean
 - Channel dredging and capping
 - Slope dredging and capping
 - Dredge and backfill
 - Enhanced natural recovery
 - Grout mat capping
 - Debris and pile removal

Dredging



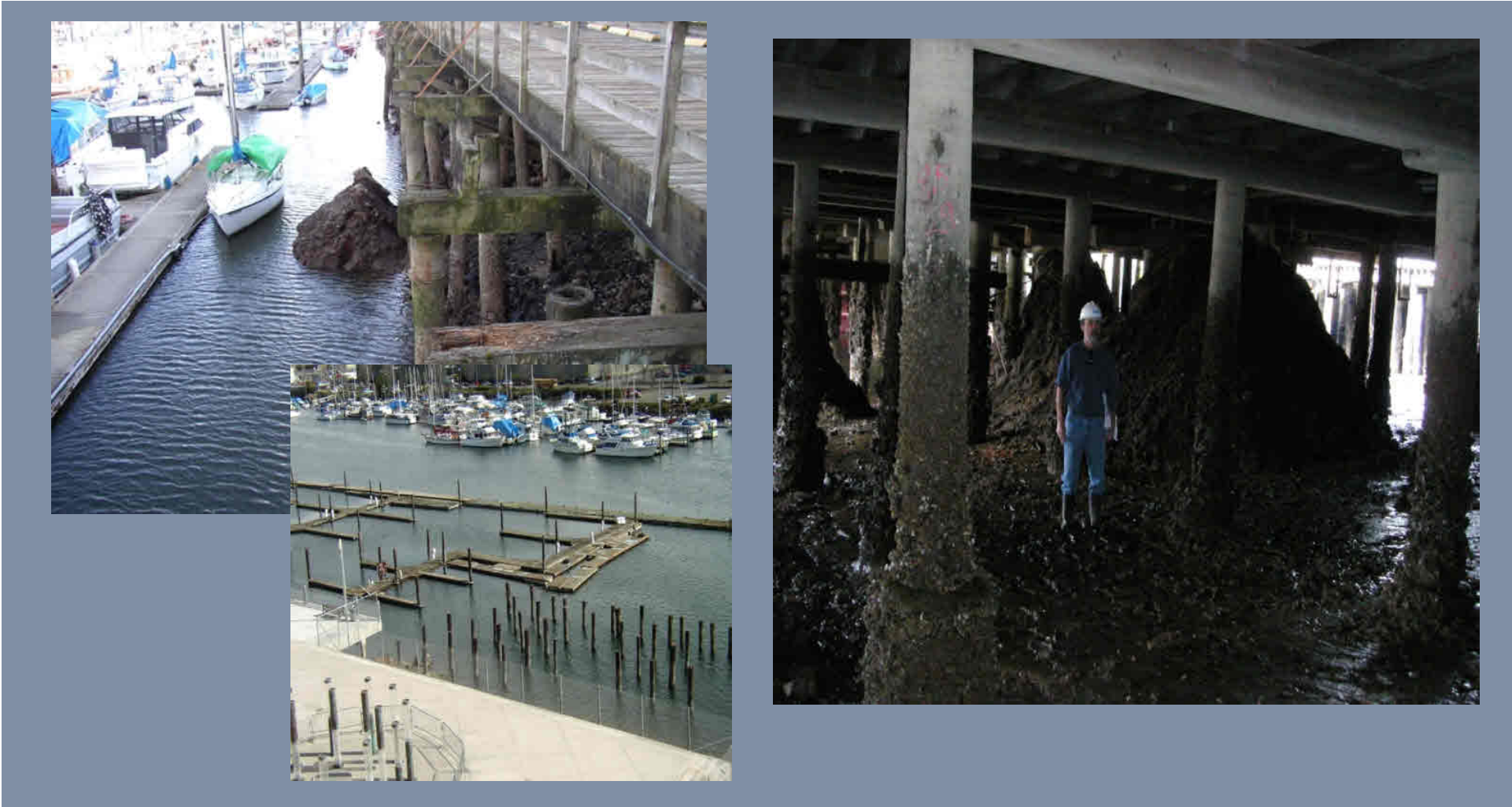
Many Forms of Capping



Polymer Sheet and Grout Mat Capping



Debris and Pile Removal



Habitat Creation and Enhancement

- Objectives
 - Actively remediate contaminated waterway sediments
 - Fully mitigate loss of St. Paul Waterway habitat
 - Contribute to the recovery of threatened and endangered species present in the Commencement Bay ecosystem
- Four new major habitat areas
- Enhancement where possible in waterway



Middle Waterway Tideflat Habitat



Puyallup River Side Channel





Esplanade Development, Upland Cleanup



Paying For It

Cleanup cost: US\$105 million

- **City of Tacoma:**
\$59.5 million
- **Other responsible parties:**
\$20.3 million
- **State grants:**
\$21.5 million
- **Other:** \$3.7 million



Economic Results

- 8-fold increase in property values
- US\$200+ million initial investment
- Museum of Glass, Albers Mill, Thea's Landing, Bridge of Glass, public esplanade
- More developments planned



What Lessons are We Learning?

- There is no silver bullet in sediment remediation. A risk-based tool box is required
- Remember the obvious: institutional control, source control, resuspension, mass balance, and monitoring
- Specify performance, not method
- Acknowledge the complexity early and often

Imagine the result