WASHINGTON PUBLIC PORTS ASSOCIATION
ENVIRONMENTAL SEMINAR
SEPTEMBER 2024

Sediment Cleanup Remedy Effectiveness and Beneficial Reuse

Clay Patmont

ANCHOR QEA

APPROACH

Sediment Cleanup Case Study Reviews

- Retrospective reviews of completed large-scale projects
  - To more broadly develop knowledge to inform future sediment cleanup remedies
- 2019 (Seattle) and 2022 (Detroit) workshops (https://www.smwg.org/)
  - 18 case studies with most robust baseline and postconstruction monitoring data
- 2024 journal manuscript focusing on completed Puget Sound cleanups
  - https://setac.onlinelibrary.wiley.com/doi/10.1002/ieam.4890


Critical Review

Puget Sound sediment cleanup remedy effectiveness retrospective

Clay Patmont[1] and Rob Healy[2]
[1]Anchor QEA, LLC, Seattle, Washington, USA
[2]Port of Tacoma, Tacoma, Washington, USA

APPROACH

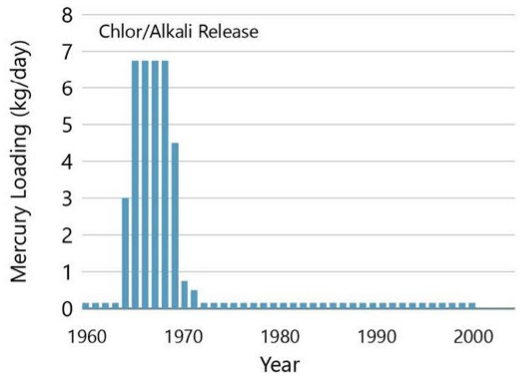
Puget Sound Sediment Cleanup Case Studies

- Particularly robust monitoring programs
  - Bellingham Bay (source control)
  - St. Paul Waterway (source control and cap)
  - Eagle Harbor (source control and cap)
  - Hylebos Waterway (source control and dredge)
  - Sinclair Inlet (source control and dredge)

- Post-construction monitoring data vs. model projections (SEDCAM)

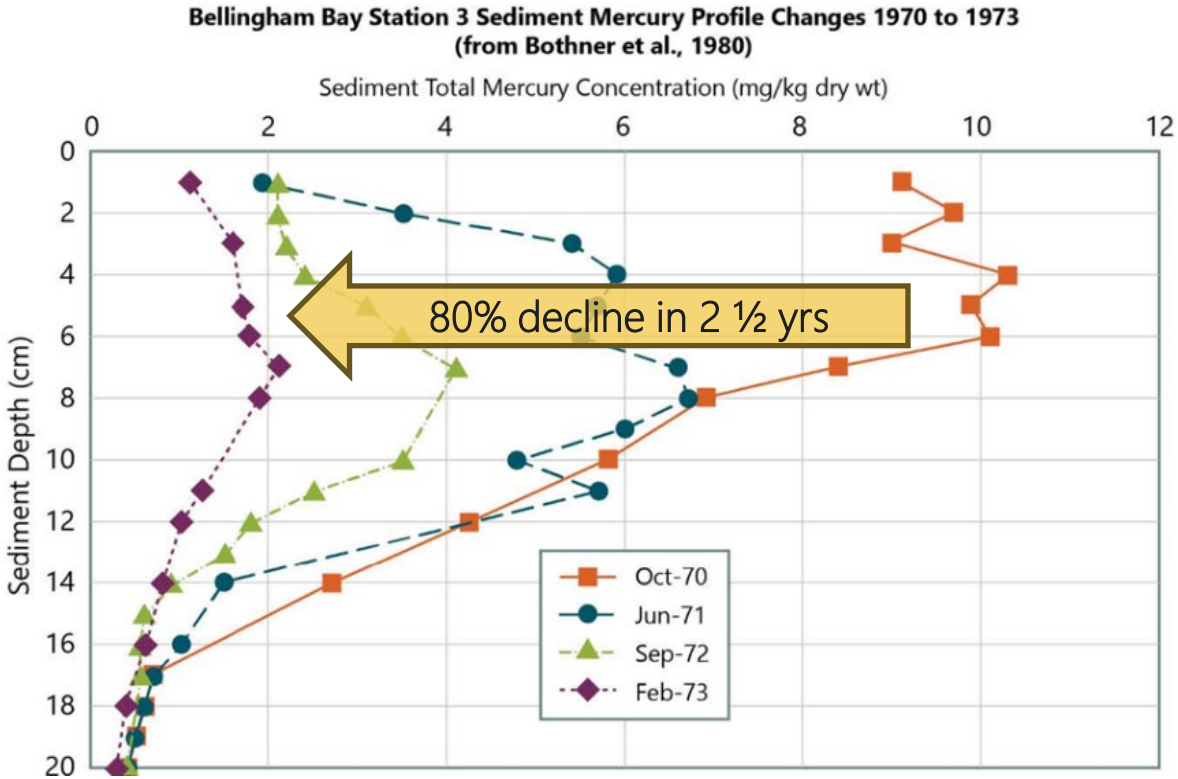
Bellingham Bay

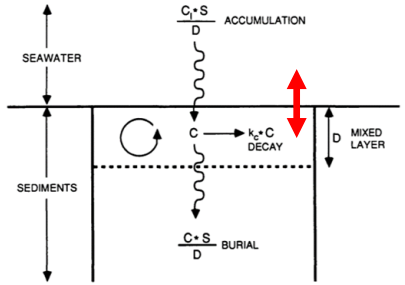
- 1965 - 1970 mercury release from former chlor-alkali facility
- 1970-1973 source controls and sediment monitoring
  - >95% mercury load reduction
  - Sediment sampling every 6 - 12 months
- Surface sediment recovery half-time projection: 6 ± 1 years (SEDCAM)



Bellingham Bay Sediment Mercury Recovery

- Observed surface sediment recovery half-time: 1.3 ± 0.2 years (5X faster)
- Concurrent porewater flux monitoring accounted for <5% of observed recovery
- Rapid recovery due to biological transfer across sediment-water interface (e.g., bioresuspension)





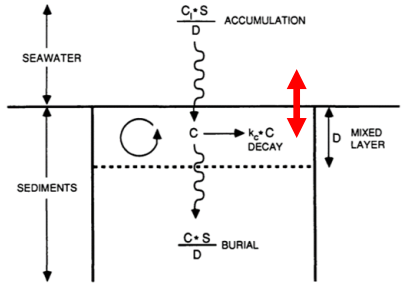
Eagle Harbor

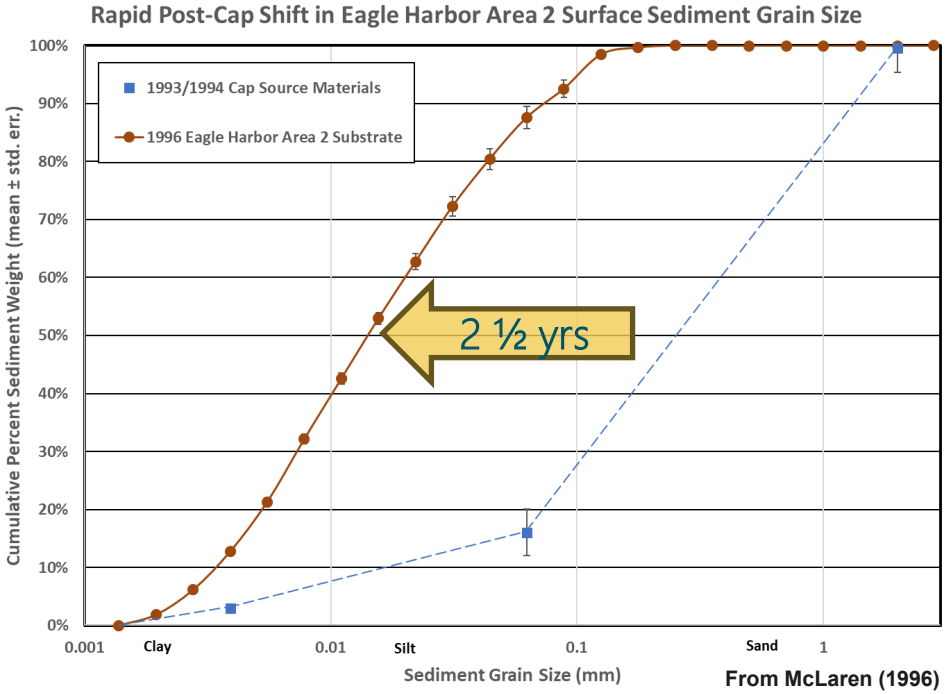
- Wood treatment (creosote) source controls since 1988 (facility closure)
- 1984 to 2010 flatfish monitoring
- 1993/1994 cap (54 acres; 3-ft-thick)
  - Area 1: sand cap placed over sand substrate
    - Primarily using bottom-dump barges
  - Area 2: sand cap placed over silt substrate
    - Sand slowly washed off flat deck barge with water jet to minimize substrate disturbance

From Sumeri (1993) and Bottcher (2019)

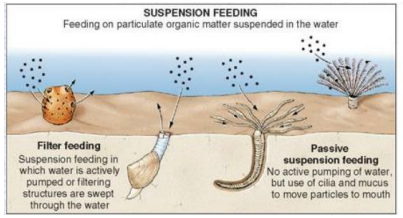
Rapid Eagle Harbor Sediment Texture Recovery

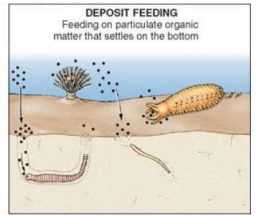
- 1996 detailed surface sediment grain size survey (2 ½ years after cap placement)
- Rapid Area 2 surface sediment grain size recovery from sand cap to silt substrate
  - Observed half-time: 1.5 ± 0.8 years (>10X faster than SEDCAM projections)
  - Rapid recovery due to biological transfer across sediment-water interface (e.g., suspension and deposit feeding)





From McLaren (1996)

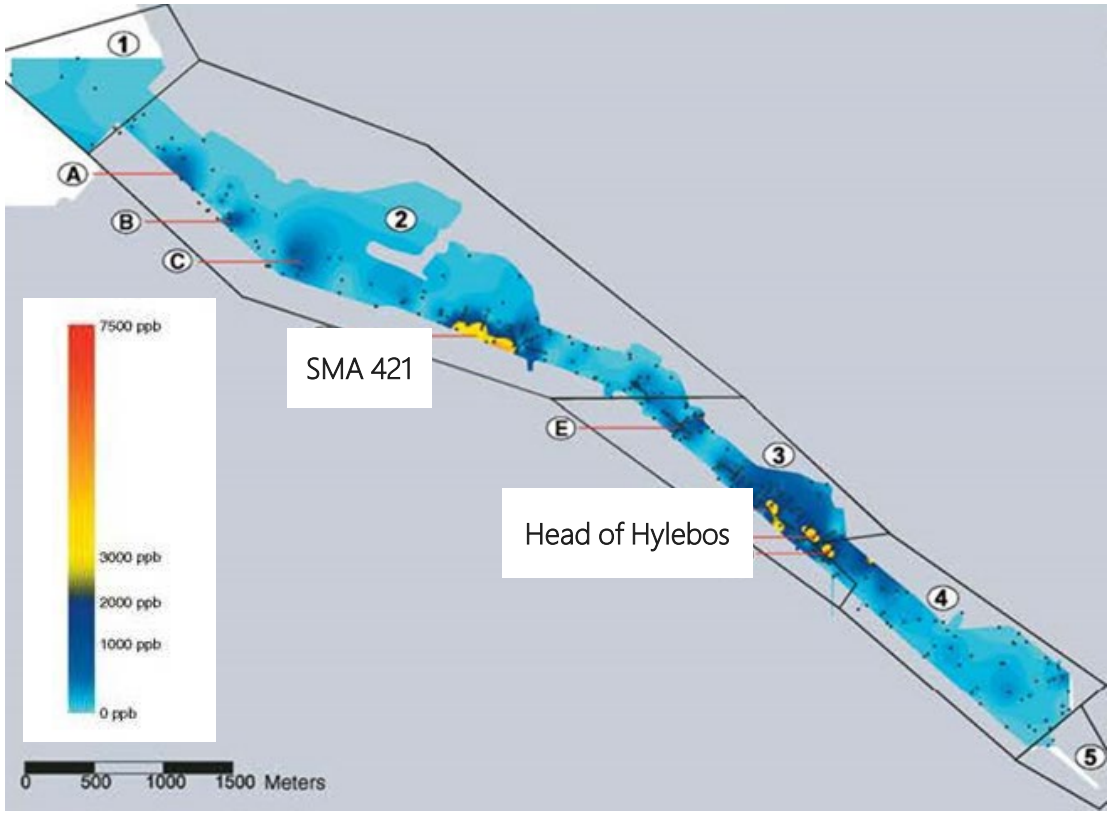




Hylebos Waterway

- 1990 - 1999 source controls
  - Extensive wastewater/stormwater controls and upland/shoreline cleanup
- 1994 - 1998 sediment PCB “hot-spots”
  - Sediment Management Area (SMA) 421
    - 1995 - 1999 shoreline source control
  - Head of Hylebos (several adjacent SMAs)
- 2004 - 2006 Waterway-wide remediation
  - 1.2 million cubic yards sediment dredged (24 acres)
  - 8 acres monitored natural recovery; 3 acres capped

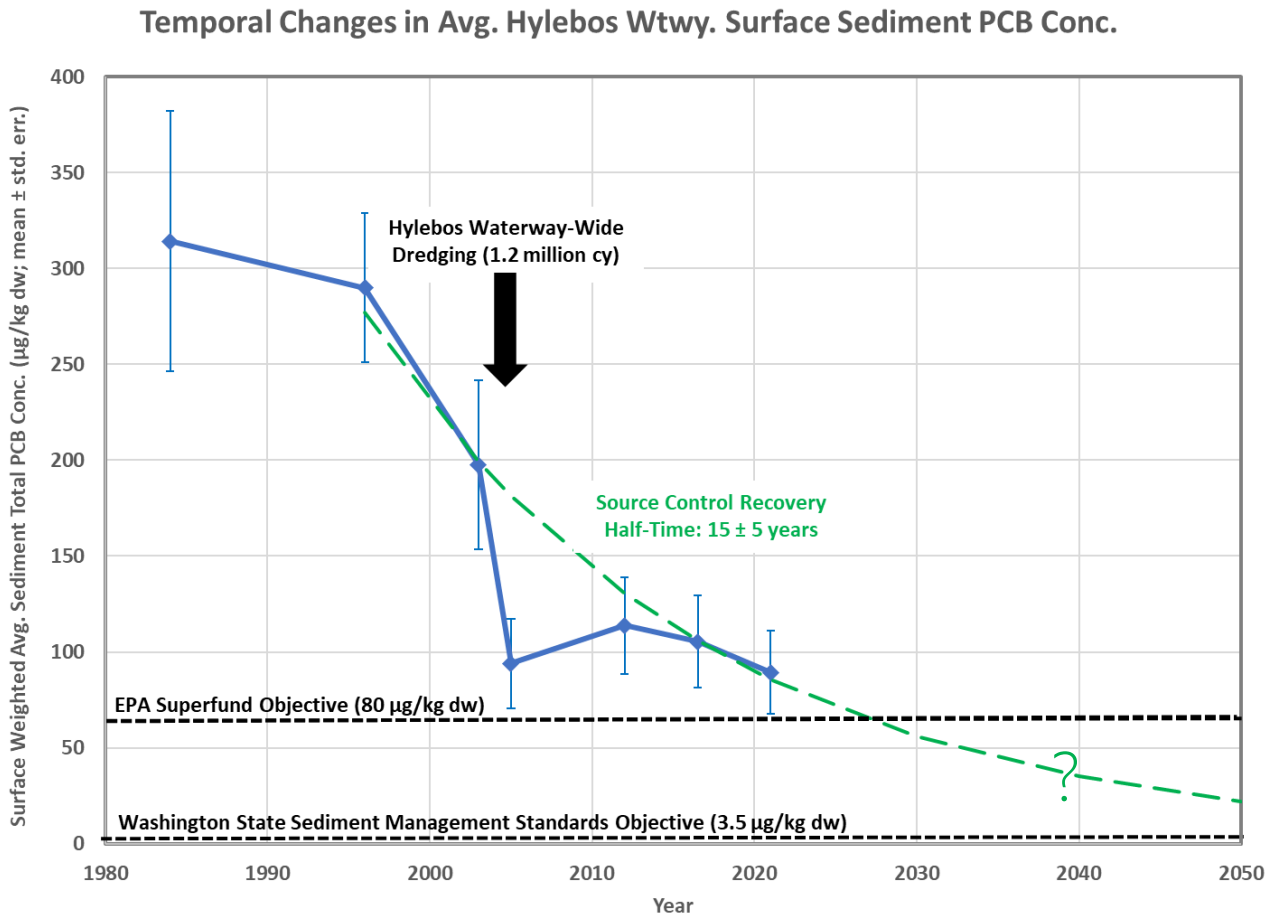
1994 - 1998 Surface Sediment Total PCB Concentrations in Hylebos Waterway

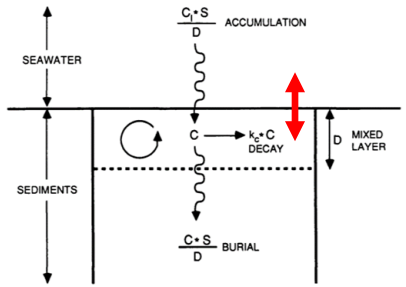


From McLaren and Beveridge (2006)

Hylebos Waterway Sediment PCB Recovery

- SMA 421 recovery half-time: 1.5 ± 0.8 years (1998 to 2003)
  - Rapid recovery due to biological transfer across sediment-water interface (e.g., bioresuspension)
- PCB recontamination after 2004 to 2006 dredging
- Waterway-wide PCB source recovery half-time: 15 ± 5 yrs
- Watershed PCB source controls continuing





LESSONS

OLEM Directive Number 9200.1-166

EPA United States Environmental Protection Agency

Office of Superfund Remediation and Technology Innovation, and Office of Research and Development

Sediment Assessment and Monitoring Sheet (SAMS)

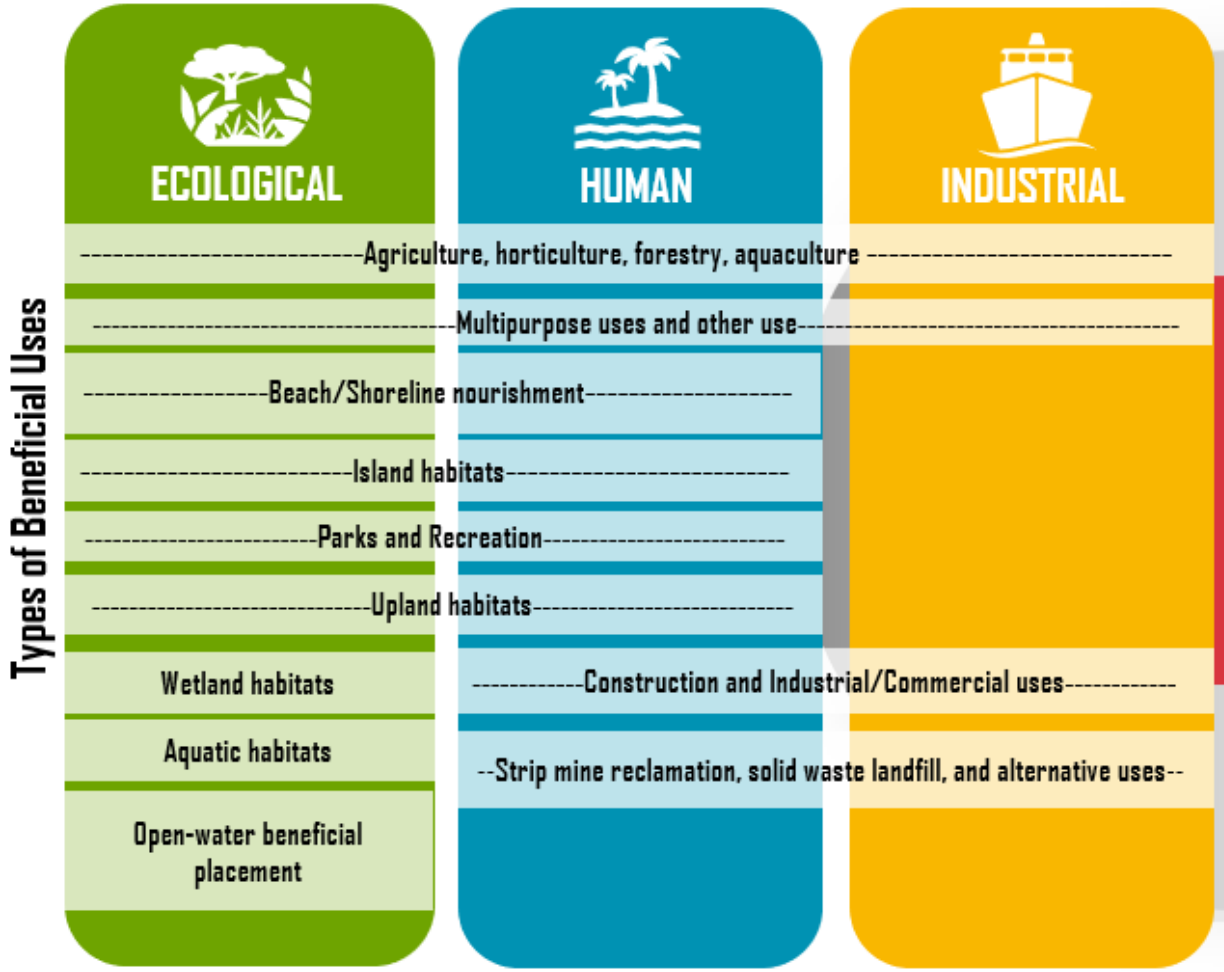
Adaptive Site Management – A Framework for Implementing Adaptive Management at Contaminated Sediment Superfund Sites

Sediment Cleanup Summary

- Rapid equilibration of Puget Sound surface sediments
  - Revealed by timely monitoring of source controls and capping
  - Recovery rates 5 ± 2 times faster than original model projections (SEDCAM)
  - Biological processes (e.g., feeding/movement) result in rapid sediment equilibration
- Diminishing linkage between fish and sediment at lower levels
- Going forward, source control in an adaptive management framework is the most efficient way to achieve protective remediation goals
  - Paradigm shift needed from broad-scale sediment remediation

BENEFICIAL USE OF DREDGED MATERIAL

DEFINITION: *Beneficial uses are defined as productive and positive uses of dredged material, which cover broad use categories ranging from fish and wildlife habitat development, to human recreation, to industrial/commercial uses.*



Achieving Our Goal

Our Goal:
70%
Beneficial Use Practices by the year
2030

- Consider dredged material a valuable resource
- Quantify and document current success in beneficial use and identify opportunities
- Examine and update existing policies
- Develop innovative solutions
- Communicate and collaborate with internal and external partners
- Make beneficial use standard operating procedure within the Corps of Engineers

More information visit: https://www.usace.army.mil/Missions/Civil-Works/Beneficial-Use-Program/

Benefits of Dredged Material Beneficial Use

- Reduces costs (public/private) of sediment management
- Faster project timelines
- Increases environmental value/benefits
- Infrastructure improvements
- Builds future sustainable workforce

Dredged Material Beneficial Use Examples

Project	Beneficial Use
Parcel 14, Port of Tacoma	Highway embankment
Jetty Island, Port of Everett	Nearshore habitat
Port of Bellingham Gate 3, Squalicum Harbor	Landfill cap
Georgia Pacific Mill Site, Port of Bellingham	**Sediment cleanup cap and habitat restoration**
City of Chelan, Don Morse Park	Beach restoration
Deer Harbor Boatworks, Orcas Island	Bank stabilization
Grant County Public Utility District, Frenchman Coulee Boat Ramp	Boat launch infrastructure
Birch Bay Village Marina Entrance Channel	Beach nourishment
Castle Rock Boat Launch, Cowlitz River	Community garden
Port Gamble Bay Cleanup	Upland backfill
Port Angeles Cleanup and Redevelopment	Upland backfill
Blair Waterway Deepening Program, Port of Tacoma	**Tony Warfield presentation**

Georgia Pacific Mill Site

- Port of Bellingham
- Clean maintenance dredge sediments from two nearby federal channels
- Cap contaminated sediments and restore intertidal and shallow subtidal habitats

Questions?