

# LOWER DUWAMISH WATERWAY, WA

DEBRA WILLISTON, KING COUNTY

SUZANNE REPLINGER, WINDWARD ENVIRONMENTAL

# Lower Duwamish Waterway

- Located in Seattle, Washington
- Five-mile estuarine river site



Sediment Remedy Effectiveness Symposium

# Objectives of Remediation

## Remedial Action objectives

- RAO 1: Reduce human health risks associated with the consumption of resident LDW fish and shellfish
- RAO 2: Reduce human health risks associated with direct contact (netfishing, clamming, and beach play)
- RAO 3: Reduce risk to protective levels to benthic invertebrates
- RAO 4: Reduce risks to protective levels to crabs, fish, birds, and mammals

### RISK DRIVERS

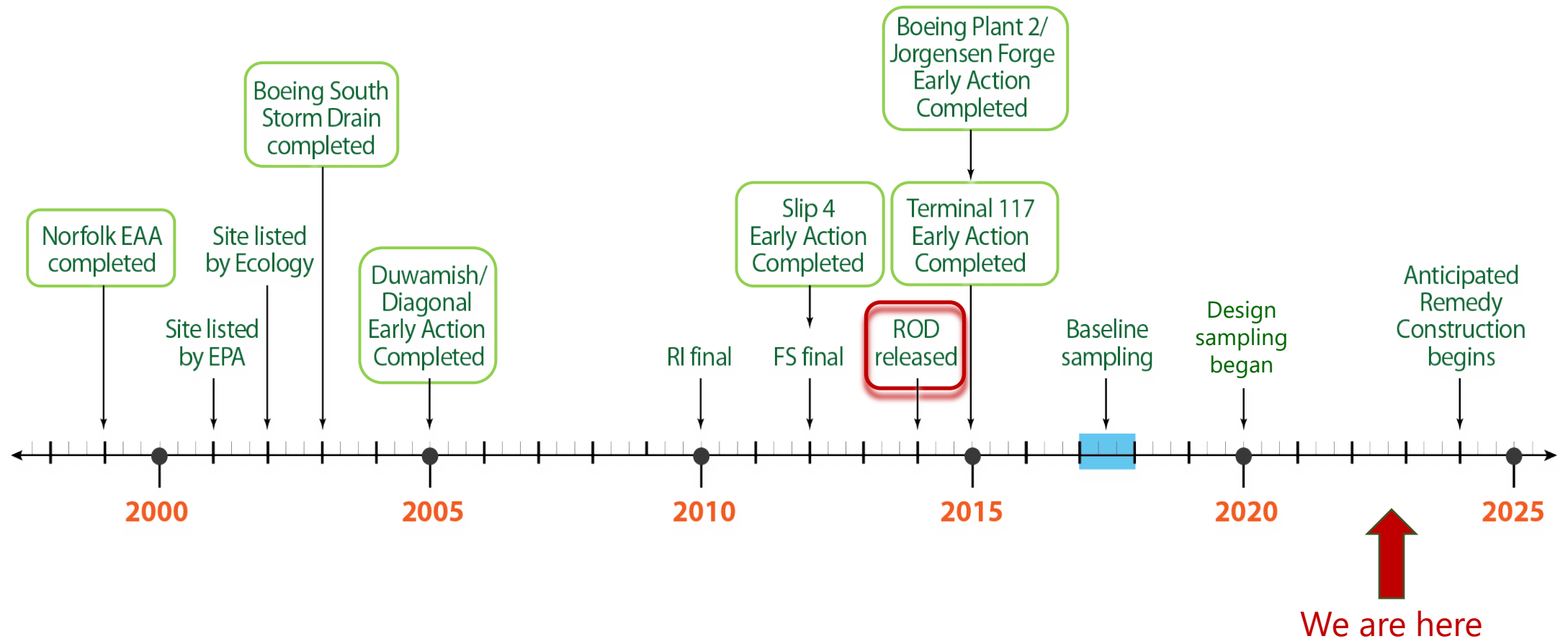
#### Human Health

- PCBs
- cPAHs
- Dioxins/furans
- Arsenic

#### Ecological

- PCBs (Otters)
- 40 Washington State SMS chemicals (benthic invertebrate community)

# Timeline



# Summary of Completed Early Actions

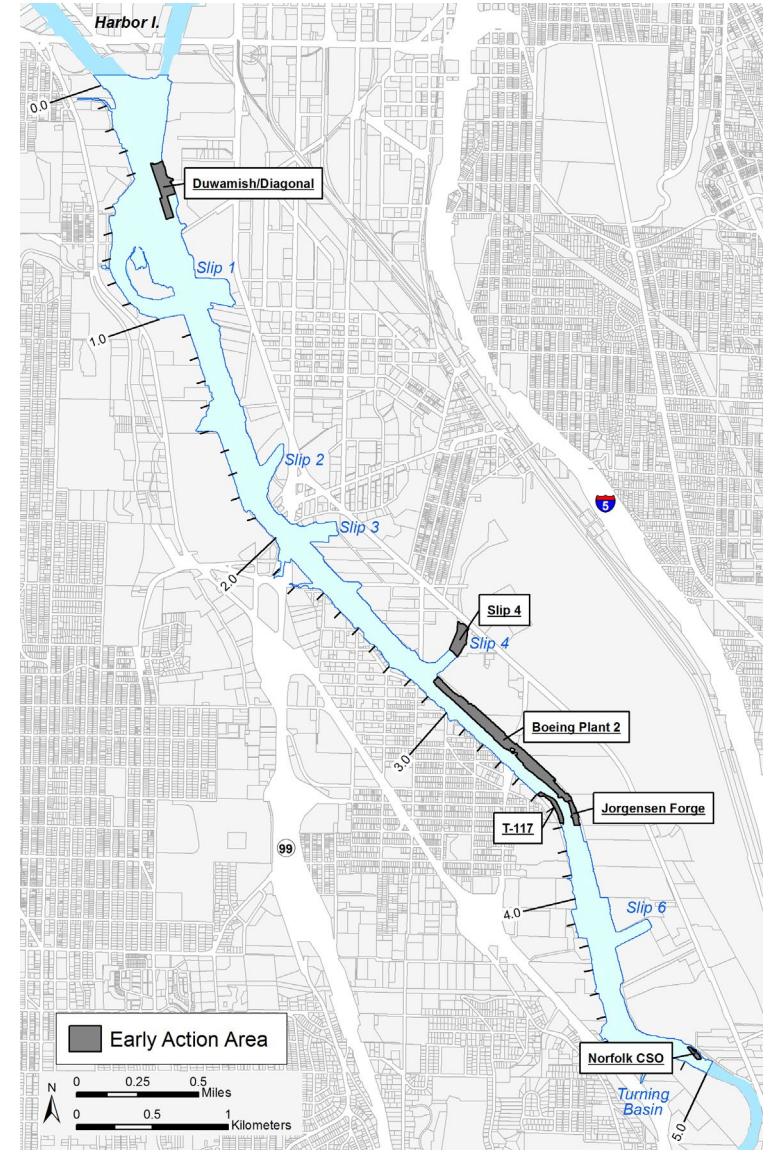
## TOTAL of 6 early actions for PCBs and other COCs

- > \$150 million
- >30 acres (of 440 acres) (7%)

EAA	Completed	Size	Cost
Norfolk CSO	1999	0.6 acres	\$2.3 million
Duwamish/Diagonal	2005	6.7 acres	\$10.1 million
Slip 4	2012	3.8 acres	\$8.1 million
Boeing Plant 2	2015	17.5 acres	\$100+ million
Jorgensen Forge	2015	1.4 acres	\$7 million
Terminal 117	2015	2.1 acres	\$28.6 million*

\* Includes 3.3 ac upland remediation

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# Significant Remedy Scope or Schedule Deviations from What Was Originally Envisioned?

- In 2000, initial discussions envisioned a streamlined CERCLA process with early actions followed by adaptive management
- In 2001, CERCLA AOC for standard process signed by four parties
- Early actions took longer than anticipated
- In 2013 (just before the ROD), WA State sediment regulations changed adding new concepts



# When were external sources characterized and addressed?

- USEPA lead for sediment remedy
- WA Dept. of Ecology lead for source control
- Enhanced source control efforts began in the early 2000s
- Source control for Early Actions:
  - Involved targeted assessments, source tracing, and stormwater system retrofits
  - Early actions started after source control deemed sufficient to minimize likelihood of sediment recontamination above remedial action levels
- Ecology will make source control sufficiency recommendations as phased remedial design progresses from upstream to downstream

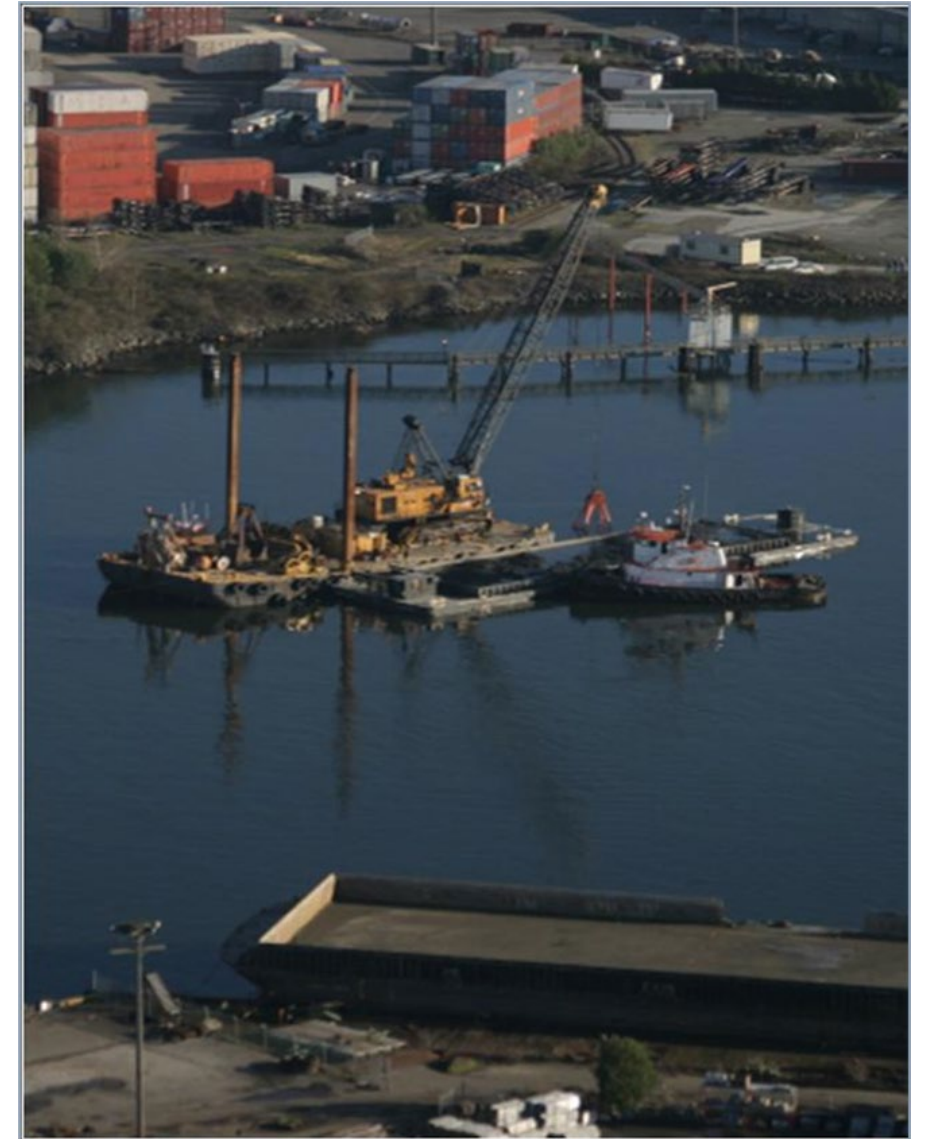
# Primary Pre- and Post-Remedy Effectiveness Monitoring Elements

- **Early Action Areas**

- Post-construction compliance sediment sampling
- Long-term sediment recontamination monitoring ( $\geq 5$  years) and off-site residuals monitoring at three areas

- **Full sediment remedy**

- Baseline sampling of sediment, surface water, and tissue (fish, clams, crabs) in 2017/2018
- Construction ~ 2024-2032 (with construction QA/QC monitoring)
- Long-term sediment, surface water, and tissue monitoring for remedial effectiveness and achievement of cleanup objectives

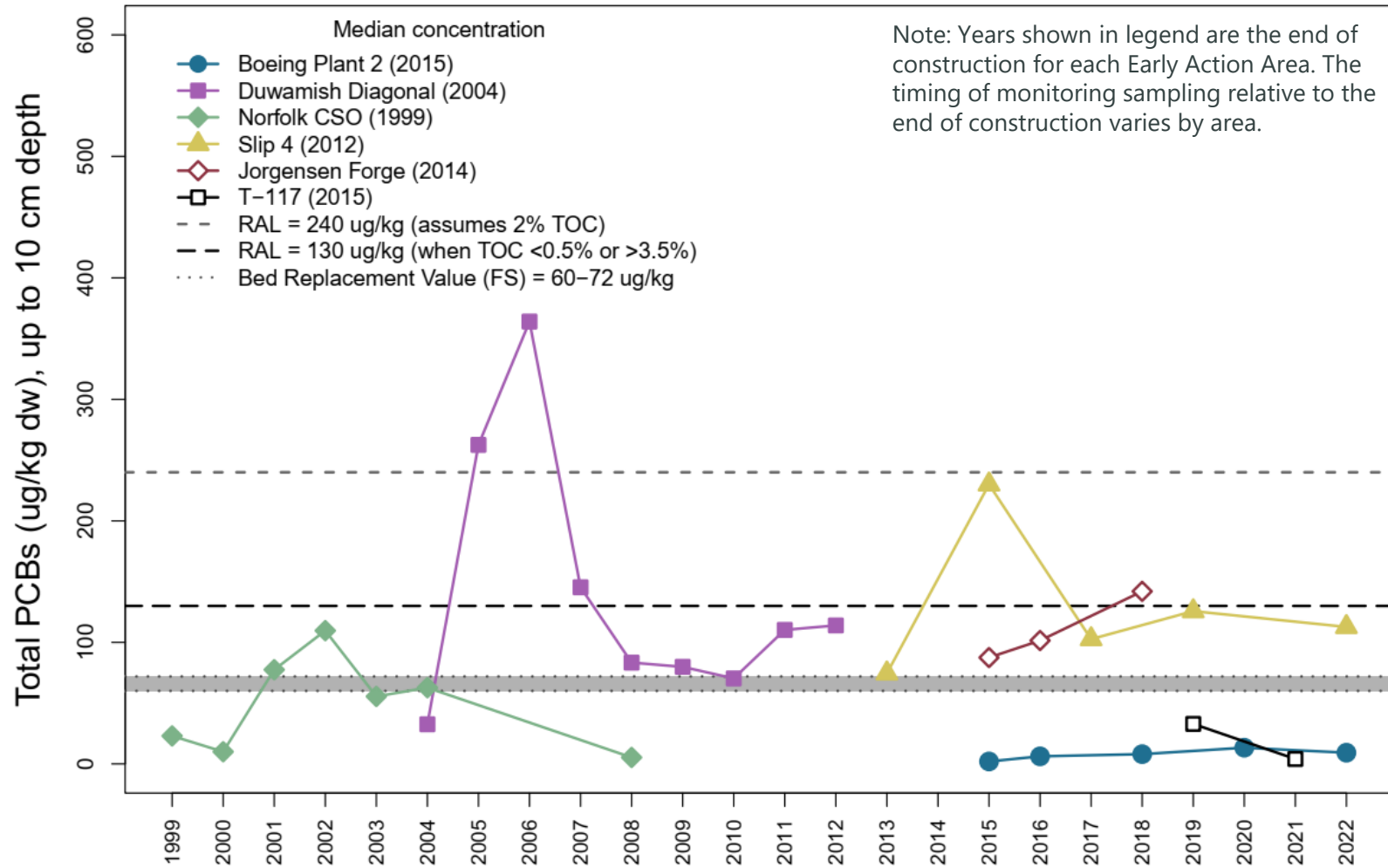




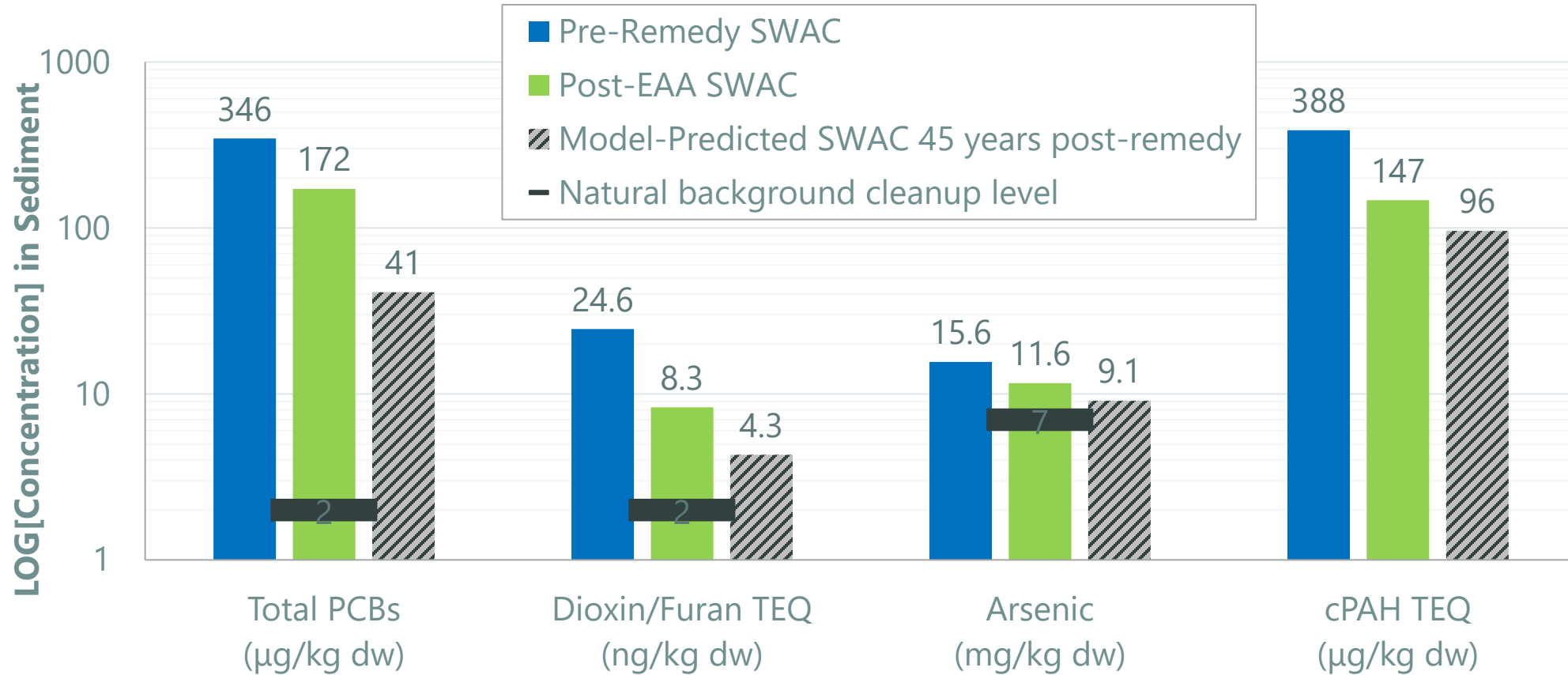
# Did the Remedy Achieve Short- and/or Long-Term Remediation Objectives for Surface Sediment?

- Generally met project-specific objectives for Early Action Areas after 1 to 2 years
- Full sediment remedy not yet begun (scheduled to begin in 2024)
  - Baseline monitoring after early actions shows 50% reduction in average site-wide PCB surface sediment concentration (consistent with modeling)
  - Model predicts that long-term site-wide sediment PCB remediation objective (2 µg/kg dw, based on Puget Sound natural background) will not be met
    - Once the remedy is complete and concentrations have reached a steady state, next steps will be determined by EPA based on a process outlined in the ROD
      - Cleanup levels may be revised by EPA

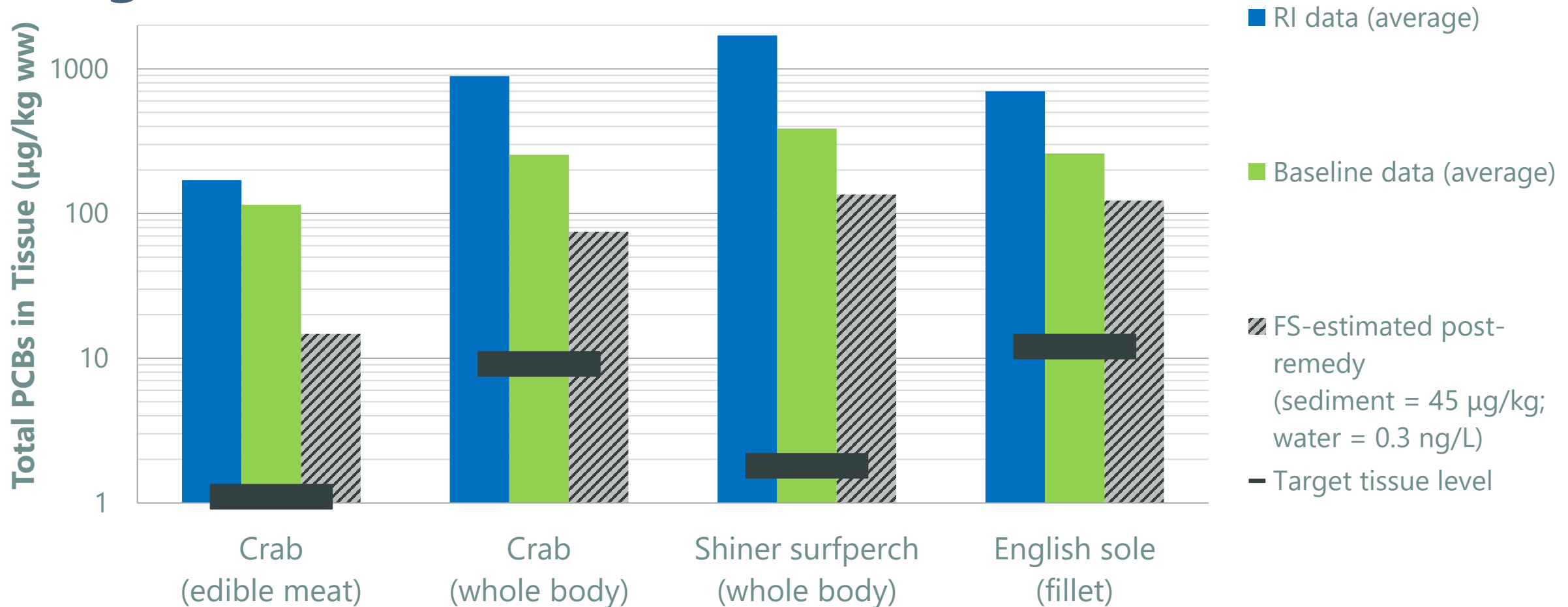
# Post-Early Action Area Sediment Monitoring



# Waterway-Wide Sediment SWACs Before and After Early Actions



# Is the Remedy on Track to Achieve Long-Term Targets for Biota?



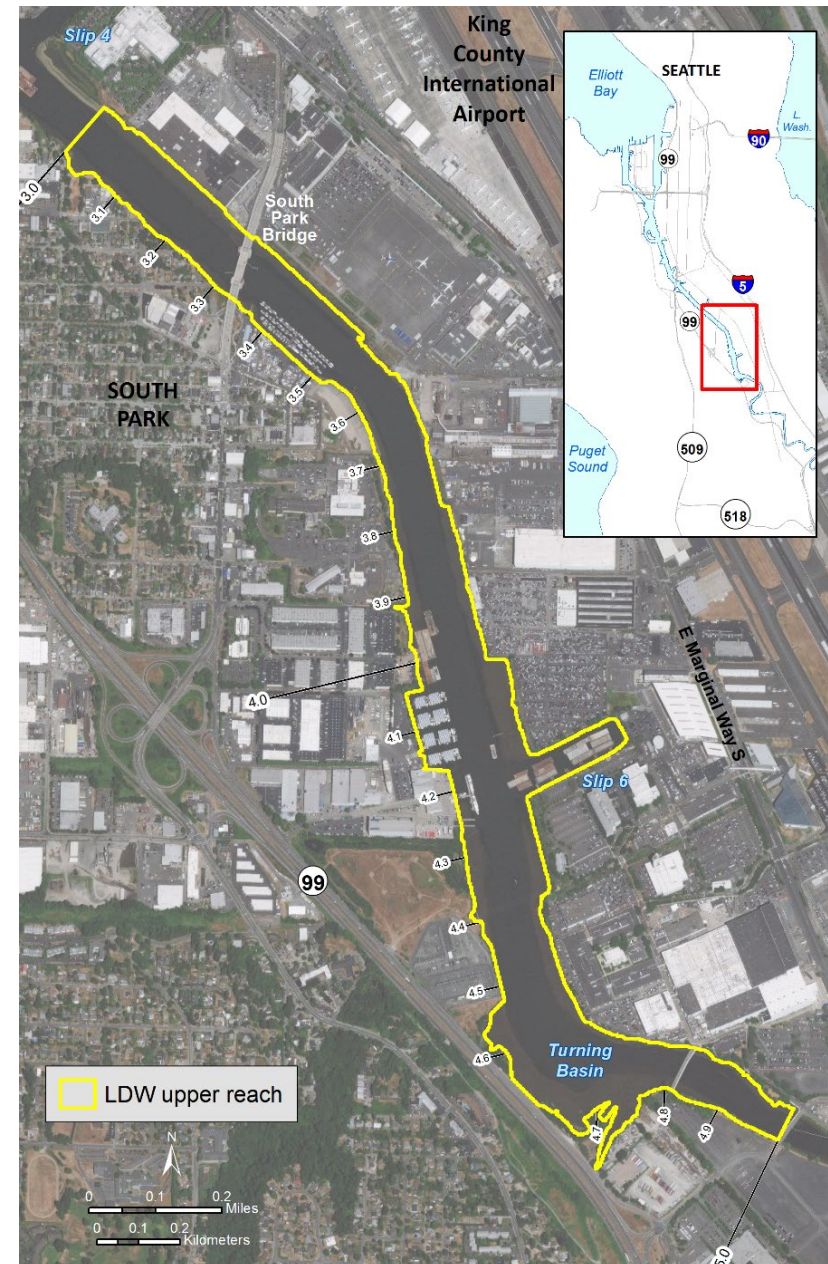
# PCB Concentrations in English Sole Fillet Tissue



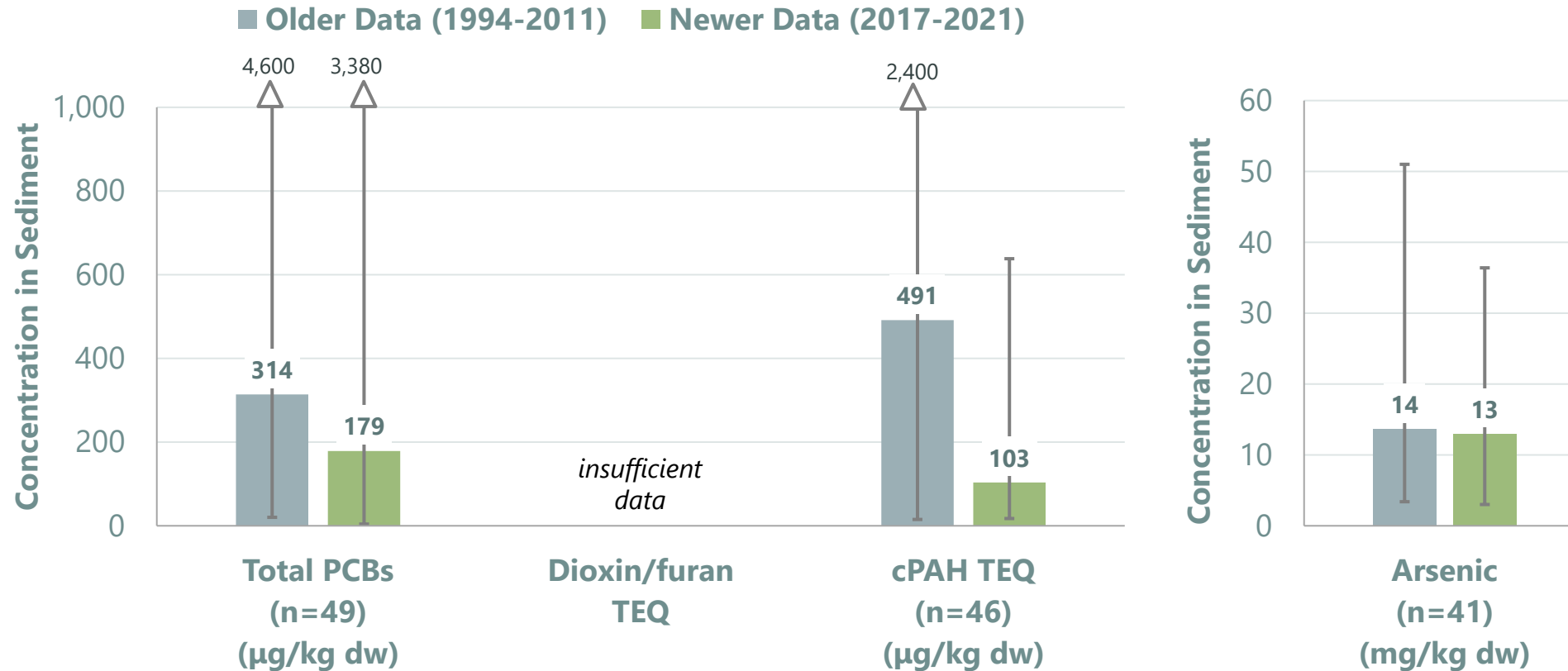
# Upper Reach: Pre-Design Investigation Sampling

- Phased sampling approach
  - Phase I = Summer 2020
  - Phase II = Summer 2021
  - Phase III = Fall 2022
- Sampling locations based on:
  - Re-occupation of select locations above remedial action levels (natural recovery)
  - Bounding areas exceeding RALs
  - Spatial coverage weighted to areas of existing contamination

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# Comparison of Sediment Concentrations at Re-Occupied Locations in the Upper Reach



# Key Take-Home Messages

- Impact of Early Actions:
  - Effective at achieving significant reductions in sediment concentrations
  - No significant reduction in fish/crab seafood consumption risk (yet)
- Robust baseline data and monitoring are important
- Source control is resource intensive and critical
- Natural recovery is occurring following hot spot remediation and ongoing source control
- EPA and PRPs need to work together in these complex urban sites to set realistic expectations and speed them up to the extent possible
- For more information, visit: [LDWG.org](http://LDWG.org)