



# Early Assessment of the Overall Effectiveness of the Upper Hudson River Remedy



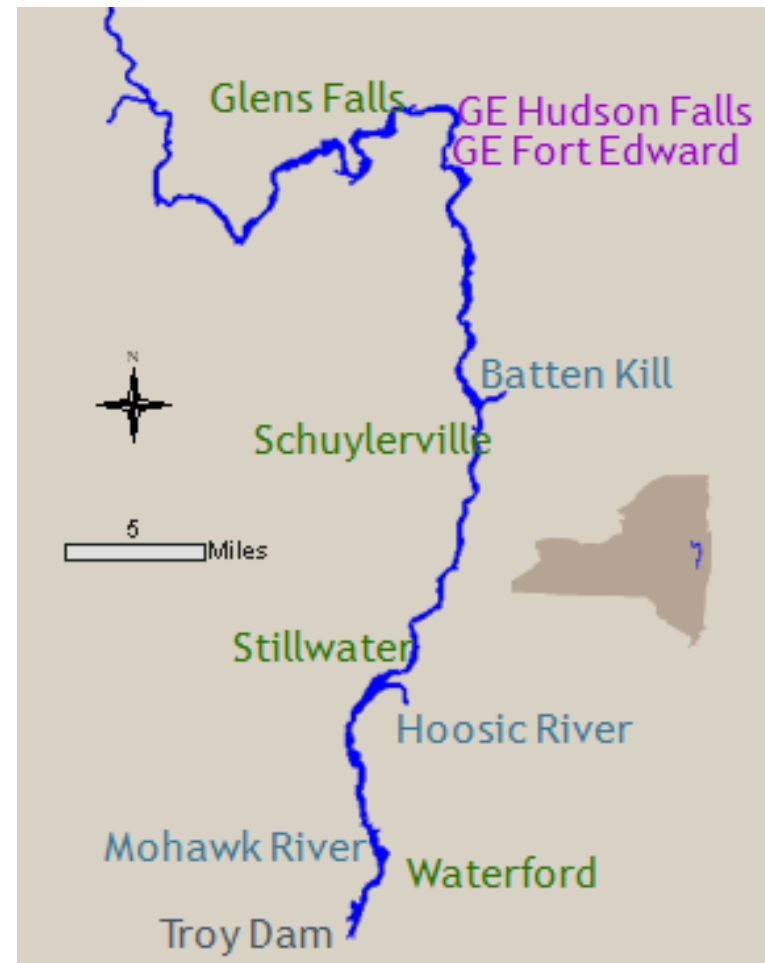
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February 12, 2019

# Upper Hudson River Superfund Site

- 40-mile stretch from Fort Edward to Troy, New York
- 2002 ROD: combined remedy of dredging, cap/backfill, and natural recovery
- Completed 500 acres of dredging and cap/backfill placement
  - Phase 1: 2009
  - Phase 2: 2011 to 2015



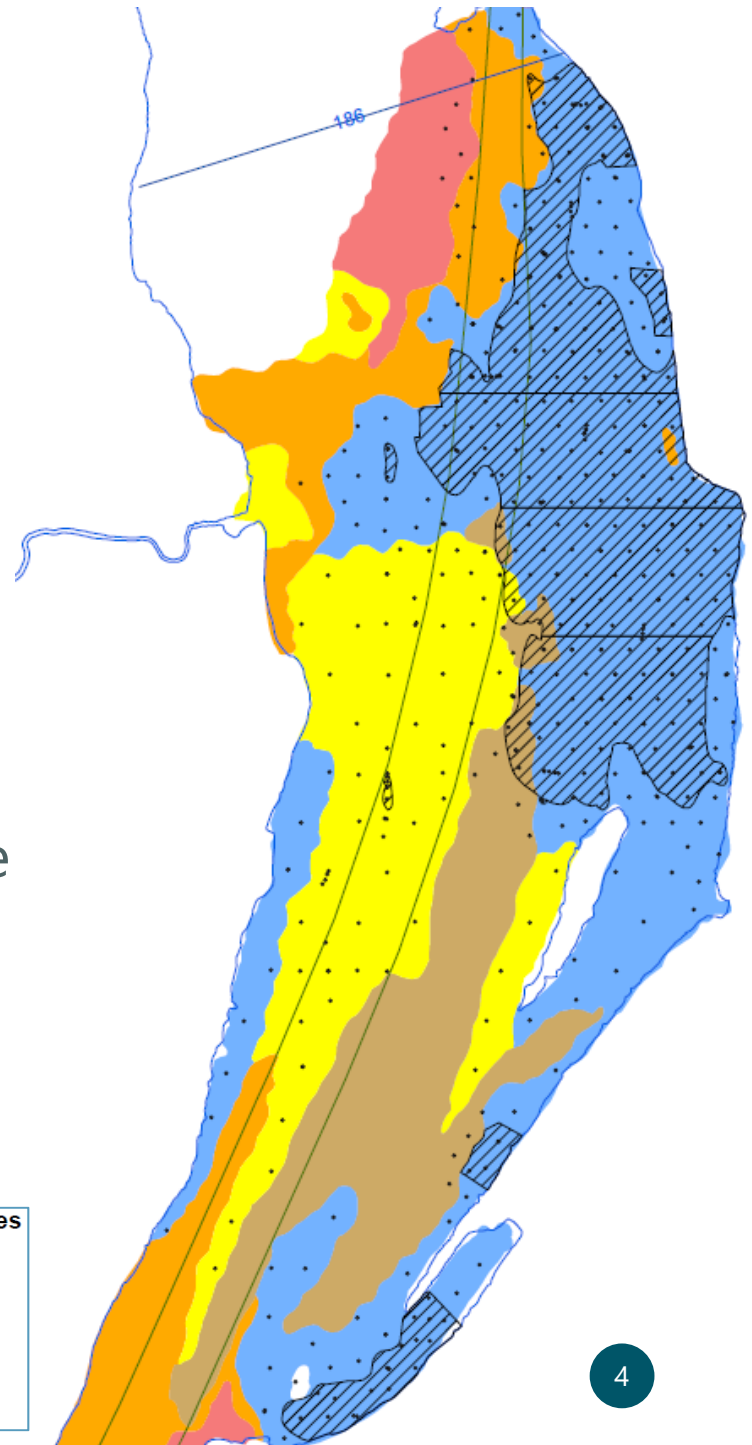
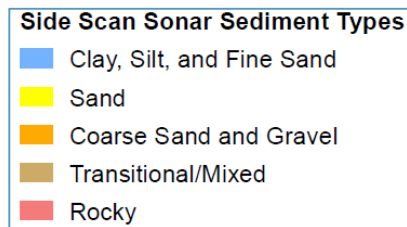
# Performing an Early Assessment

- Remedial goals are focused on water and fish
- Fish PCB concentrations are highly variable
  - Habitat and prey availability from year to year
  - Bioenergetics
  - River flow
  - Temperature
- Many years of fish PCB data are needed to overcome factors that cause variability and assess a trend

Sediment and water data provide an early indication of remedy effectiveness.

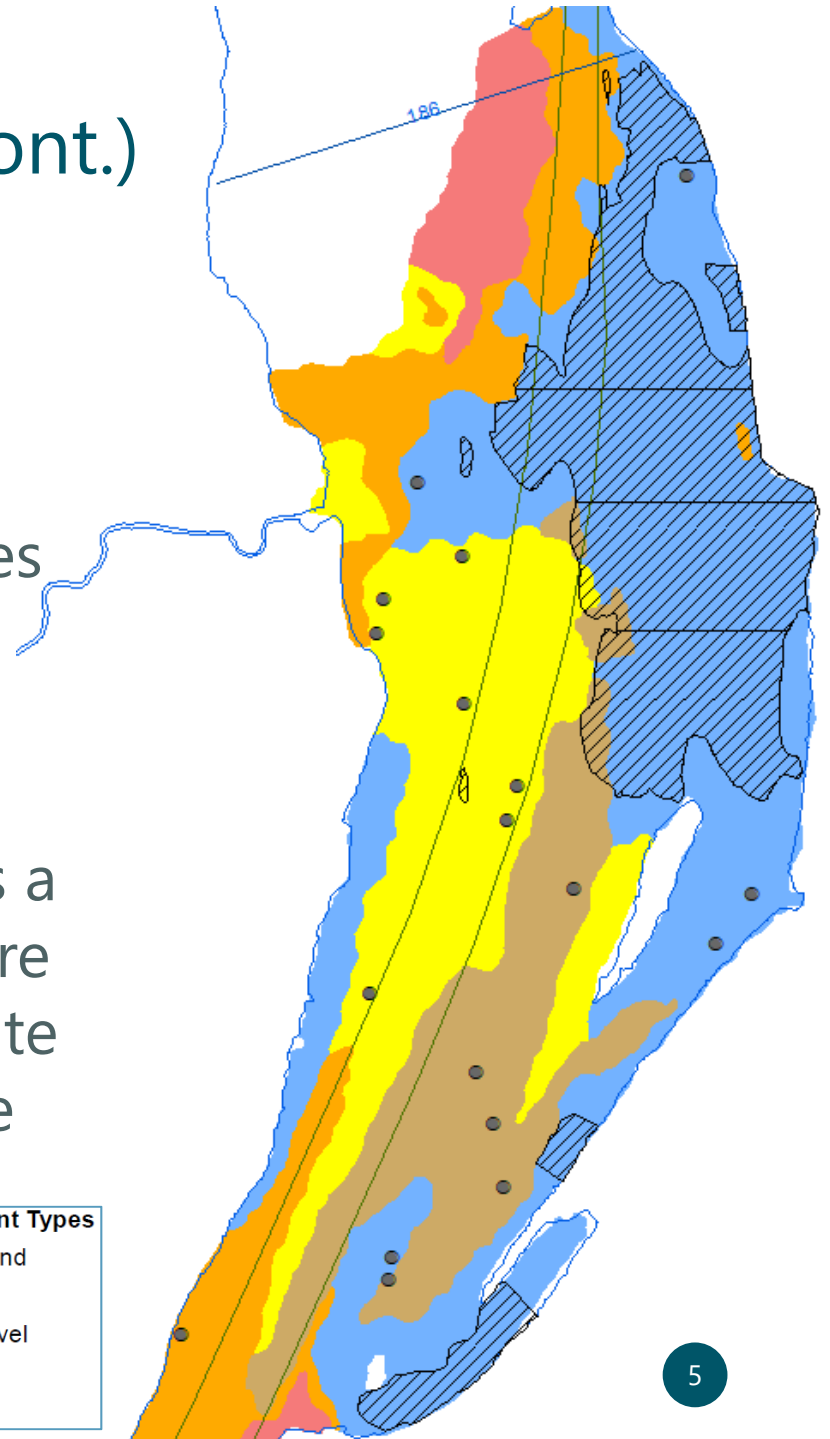
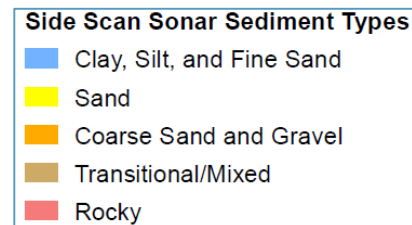
# Available Sediment Data

- Design data
  - Collected 2002 through 2012
    - Majority from 2002 to 2005
  - More than 10,000 sediment cores
  - Characterize surface and deep sediment as part of remedial design
  - Identify and delineate areas where PCBs exceeded the ROD thresholds
  - Only top section of core used to represent surface sediment



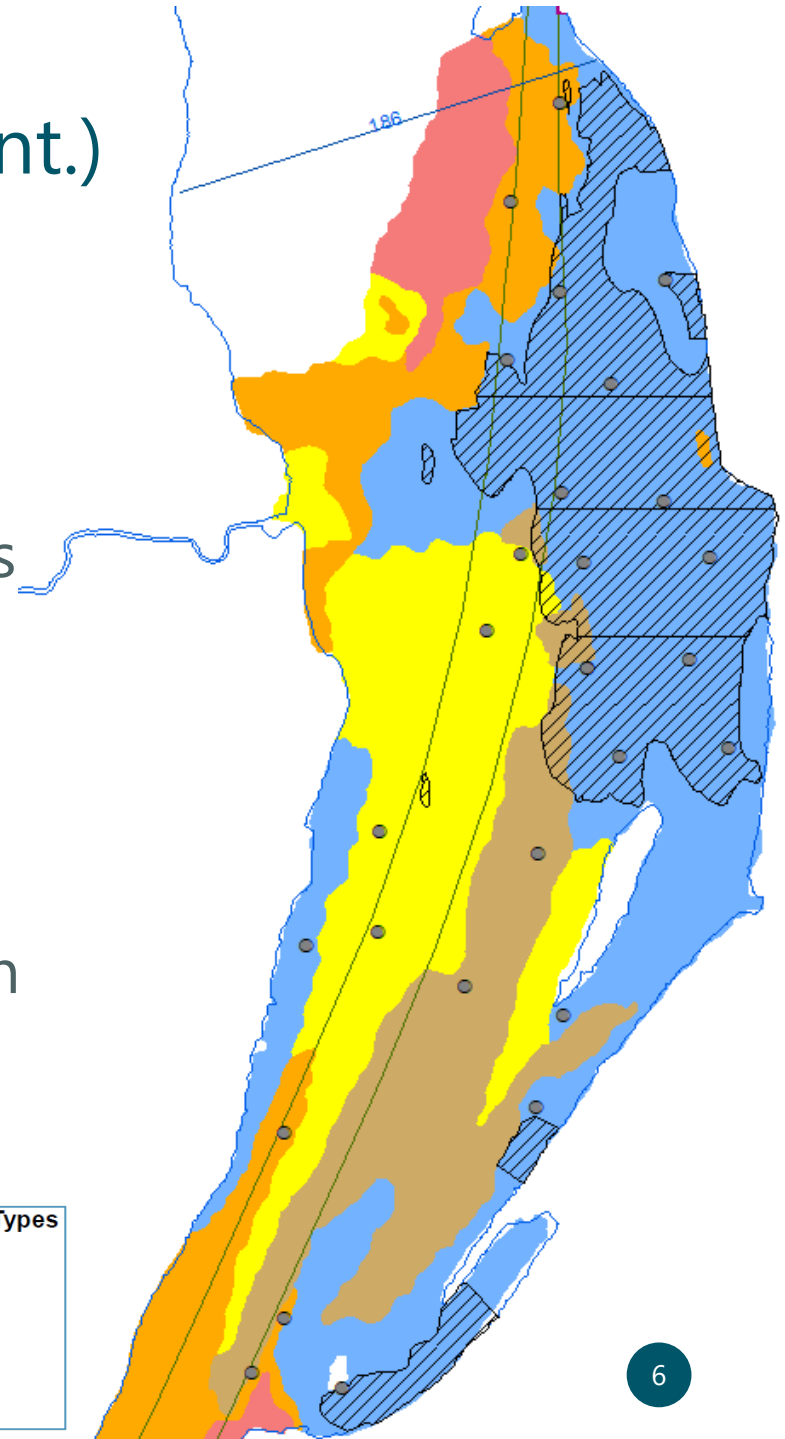
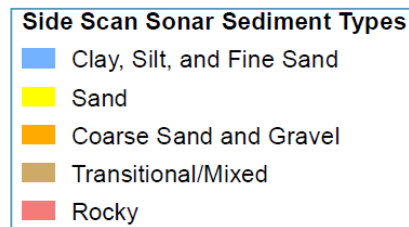
## Available Sediment Data (cont.)

- Long-term monitoring data (OMM; GE)
  - Collected in 2016
  - 215 surface sediment samples outside of dredge areas
  - Establish baseline post-remediation PCB concentrations to be used as a point of comparison for future sediment sampling to evaluate recovery rates in non-dredge areas



## Available Sediment Data (cont.)

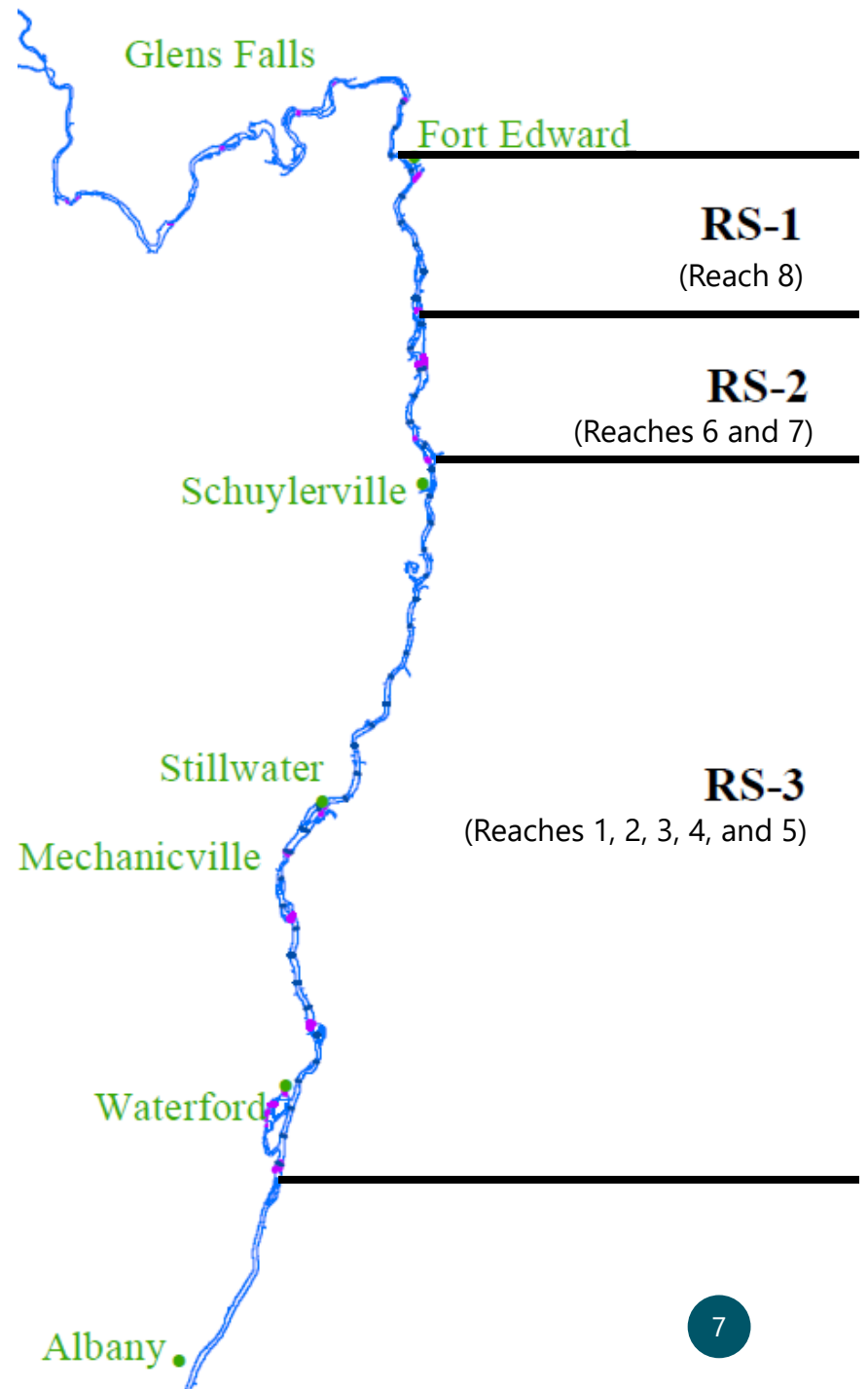
- Long-term monitoring data (OMM; NYSDEC)
  - Collected in 2017
  - 1,135 surface sediment samples
  - To evaluate performance of remedy
  - Establish baseline post-dredging PCB concentrations to use as comparison points in determining estimated sediment recovery rates



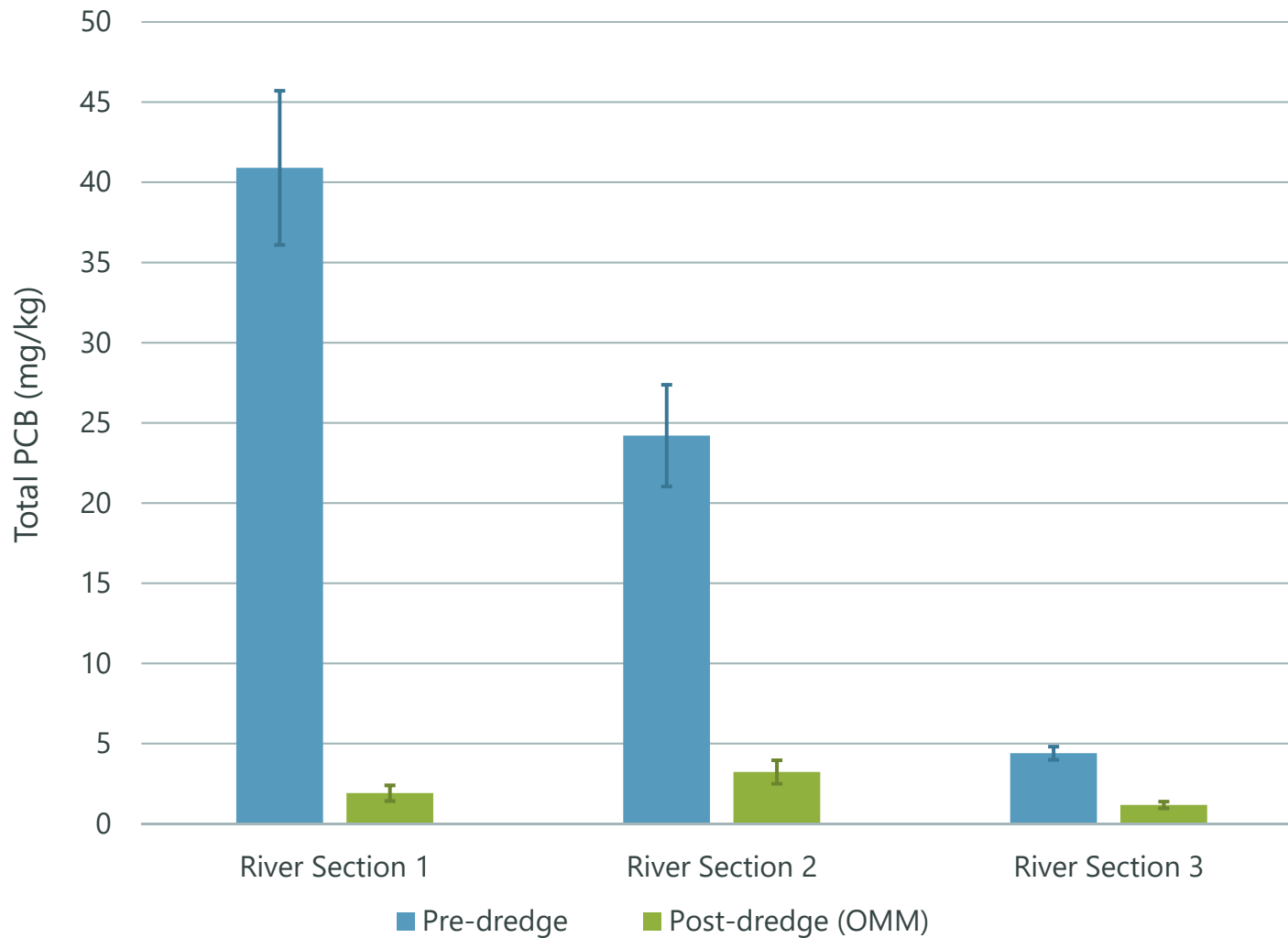


# Discretization of the Upper River

- ROD evaluated alternatives at a River Section (RS) level
- River divided into reaches due to dams
  - **RS-1**: Reach 8
  - **RS-2**: Reaches 7 and 6
  - **RS-3**: Reaches 1 through 5
- Sediment evaluations are performed at this scale
- Total PCB and Tri+ PCB basis



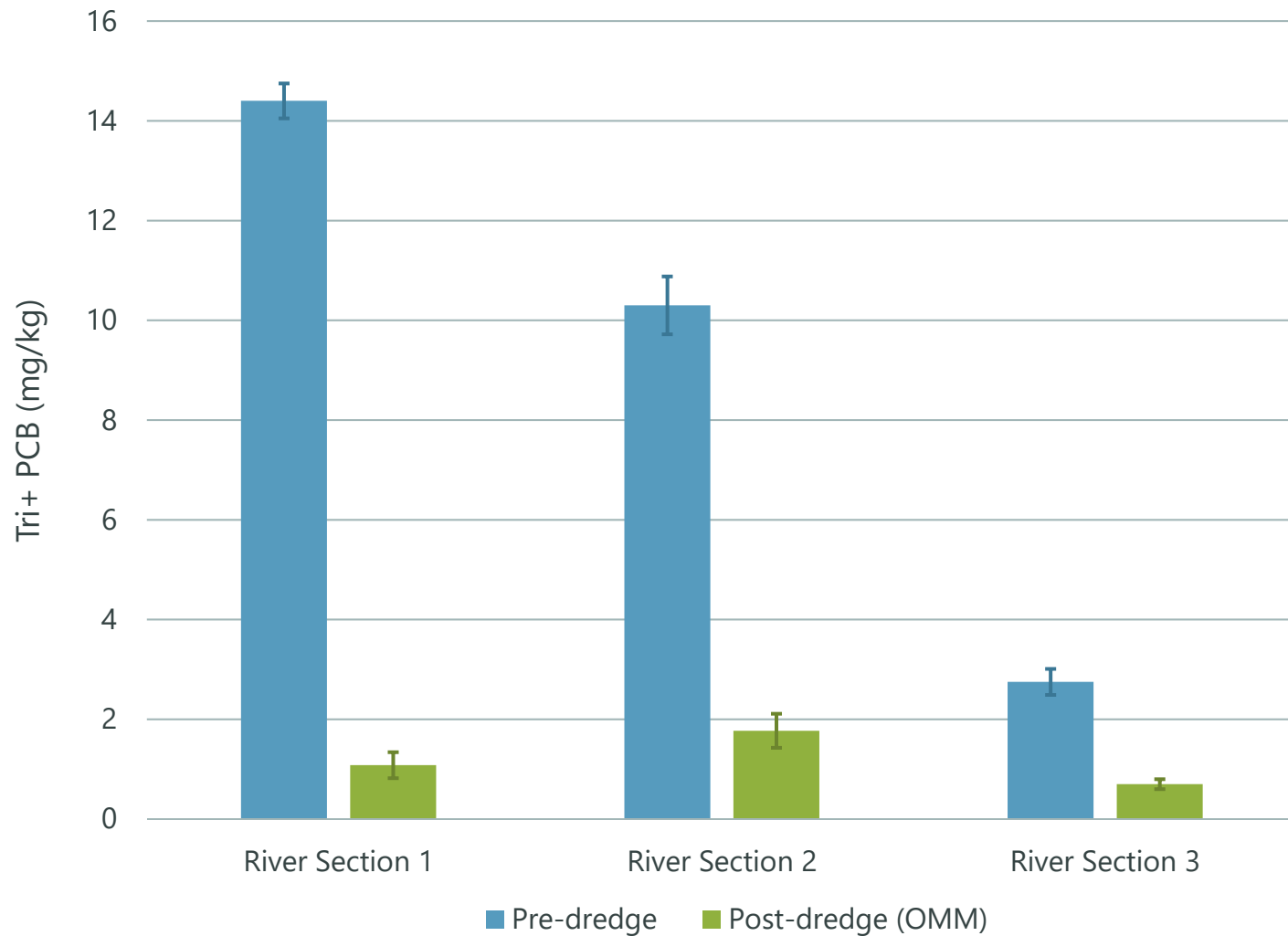
# Average Surface Sediment Total PCBs



*Averages are spatially weighted.*



# Average Surface Sediments Tri+ PCBs



*Averages are spatially weighted.*

# Sediment Results: Comparison to Predictions

River Section	Tri+ PCB Surface Concentration (mg/kg)		% Decline	
	Pre-Dredge Average	Post-Dredge Average	Measured	Record of Decision Predicted
1	14.2	1.1	92%	79%
2	11.0	2.1*	81%	64%
3	3.3	0.7	79%	4.4%

Note:

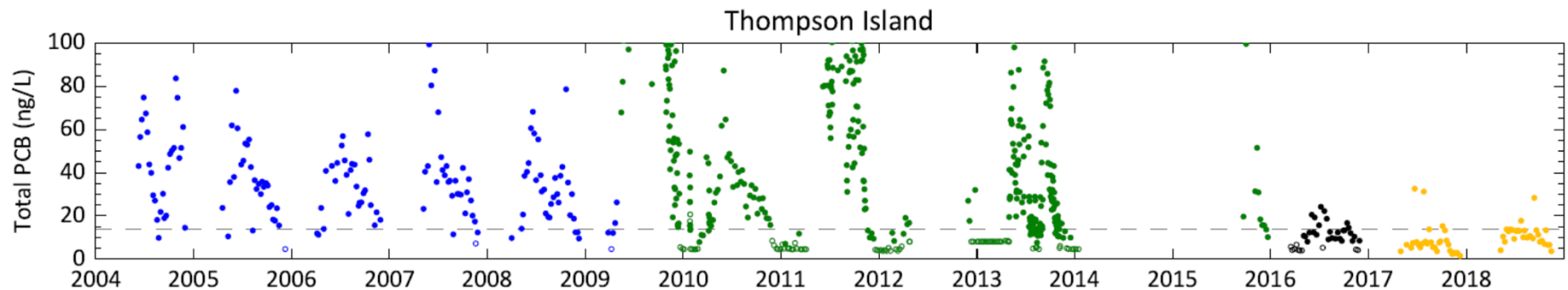
\* Average ranges from 1.8 to 2.1 mg/kg, depending on datasets incorporated. Averages taken from 2012 Five Year Review and 2017 Draft Five Year Review. Bedrock excluded from spatial average.

# Available Water Data



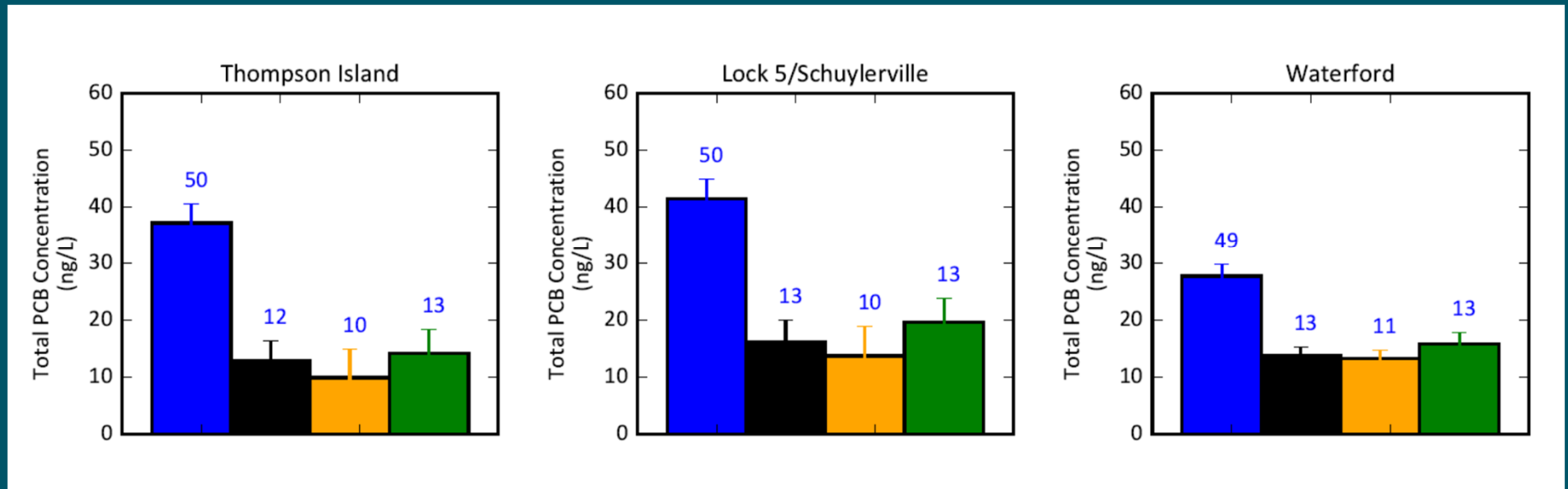
- Pre-dredge: 2004 – 2008
- Post-dredge: 2016 – 2018
- Upper river
  - Three stations sampled weekly during non-winter months
  - One station (consistently) for high flow
- Lower river
  - Two stations with monthly data
  - 9 miles and 78 miles downstream from Federal Dam at Troy

# Consideration of Flow and Seasonal Variation



- PCB comparisons needs to account for
  - Variability due to flow
  - Seasonal fluctuations
- Assessment for summer low-flow
  - July through September
  - Less than 5,000 cfs at upstream flow gage for Upper river
- Assessment for high flow
  - More than 15,000 cfs at upstream station

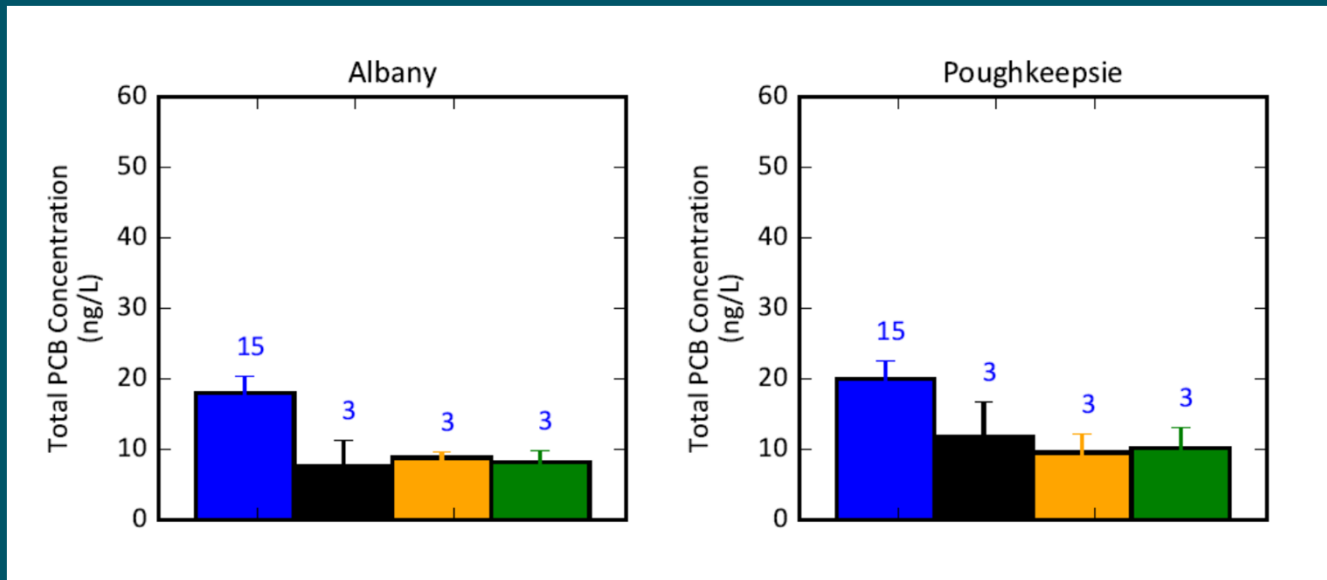
# Summer Low-Flow Average on Upper River



*Numbers above bars are number of data points per average.*

**Pre-dredge (2004-2008)**   **Post-dredge (2016)**   **Post-dredge (2017)**   **Post-dredge (2018)**

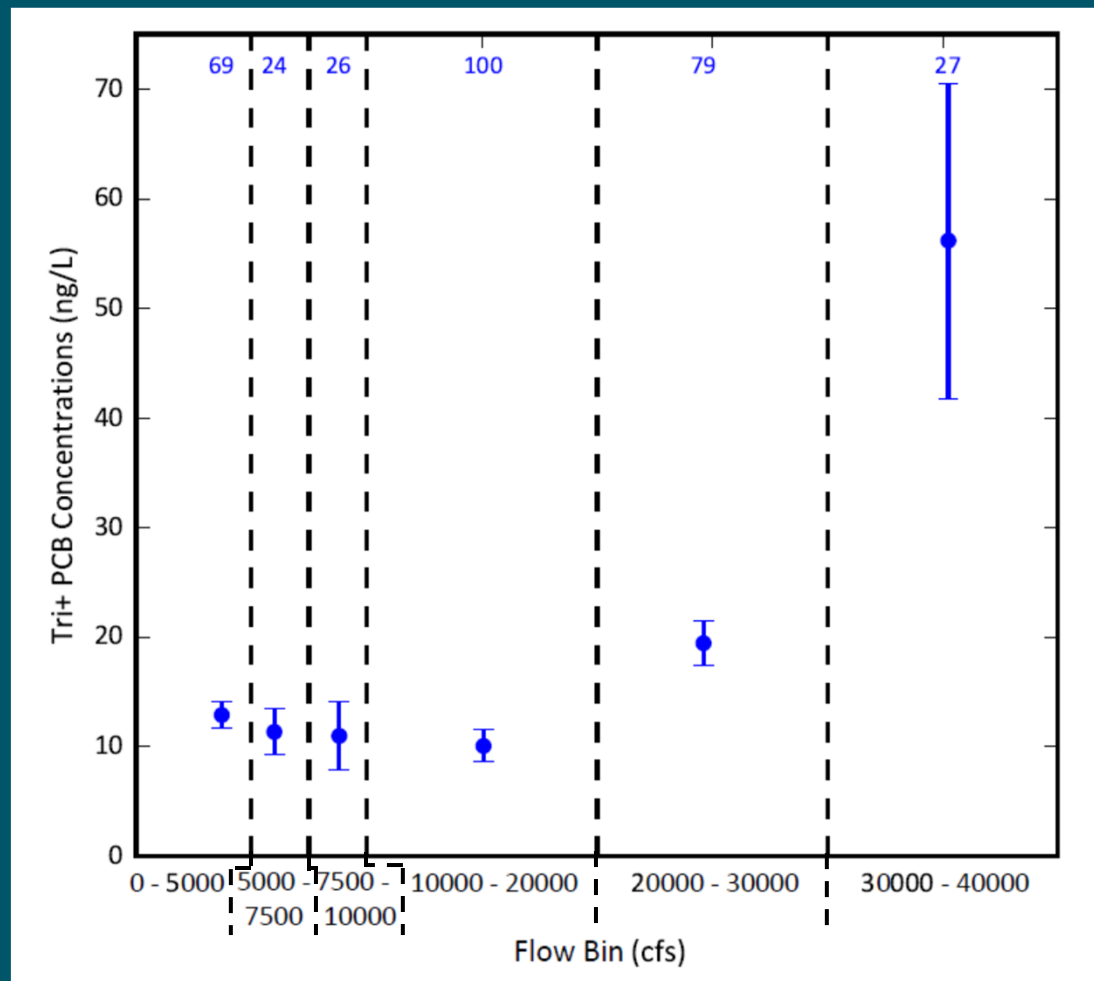
# Summer Average on Lower River



*Numbers above bars are number of data points per average.*

**Pre-dredge (2004-2008)**   **Post-dredge (2016)**   **Post-dredge (2017)**   **Post-dredge (2018)**

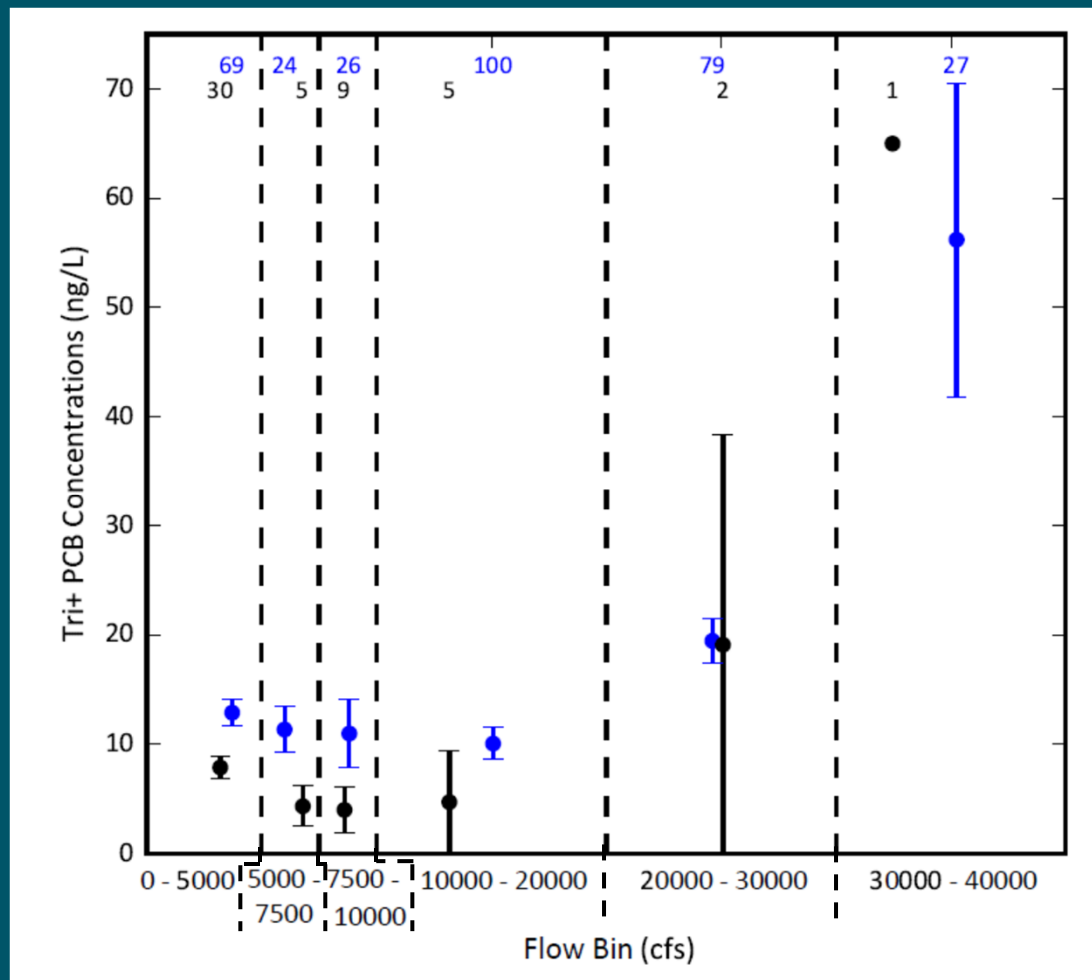
# High Flow



 Pre-dredge (2004-2008)

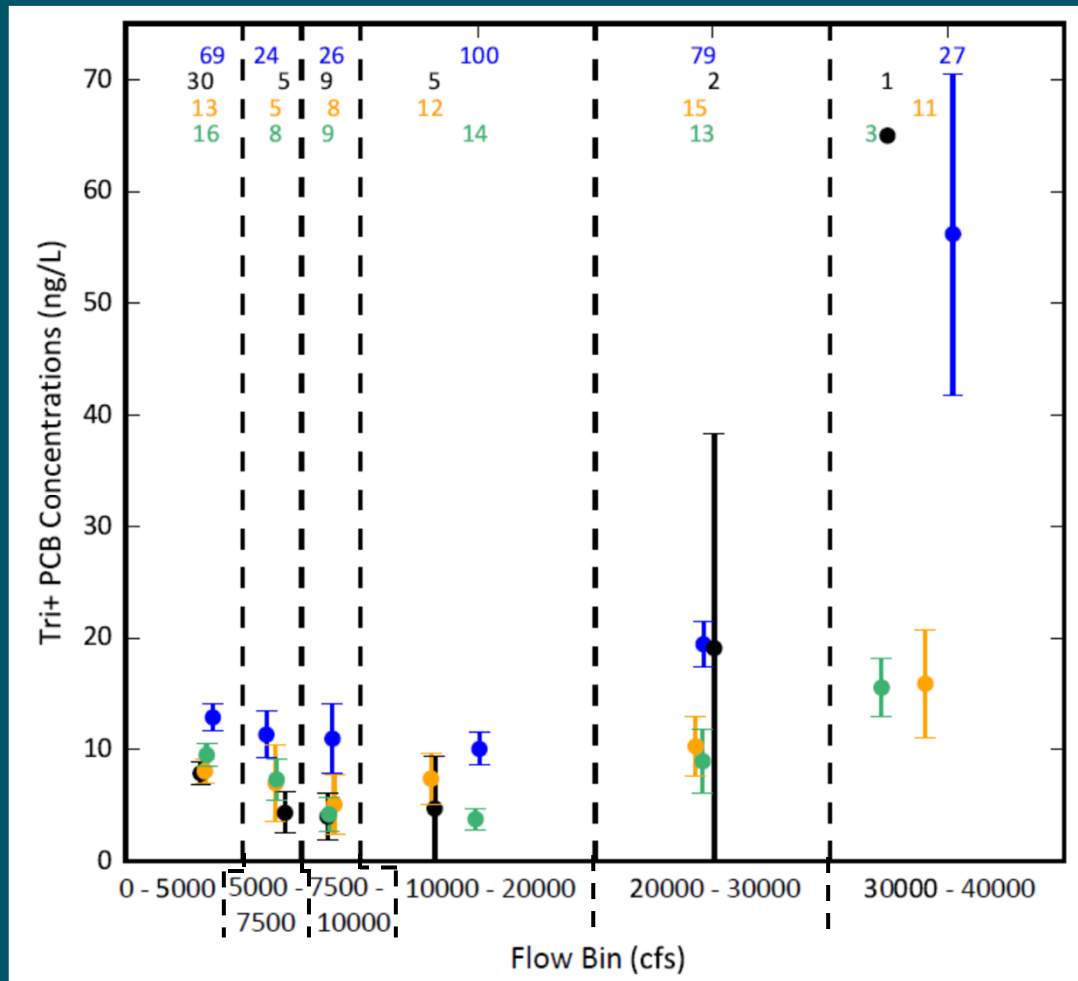


# High Flow



■ Pre-dredge (2004-2008) ■ Post-dredge (2016)

# High Flow



■ Pre-dredge (2004-2008) 
 ■ Post-dredge (2016) 
 ■ Post-dredge (2017) 
 ■ Post-dredge (2018)

# Conclusions

- Early assessment indicates the remedy has reduced surface sediment concentrations up to 92%
- Water column concentrations have been reduced for high- flow and low-flow conditions
- Many more years of PCB data are needed before a trend can be assessed for fish





# Questions/Discussion

