OTTAWA RIVER, OH

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U.S. ENVIRONMENTAL PROTECTION AGENCY, GLNPO AND ORD

GLLA Project Coordination Team

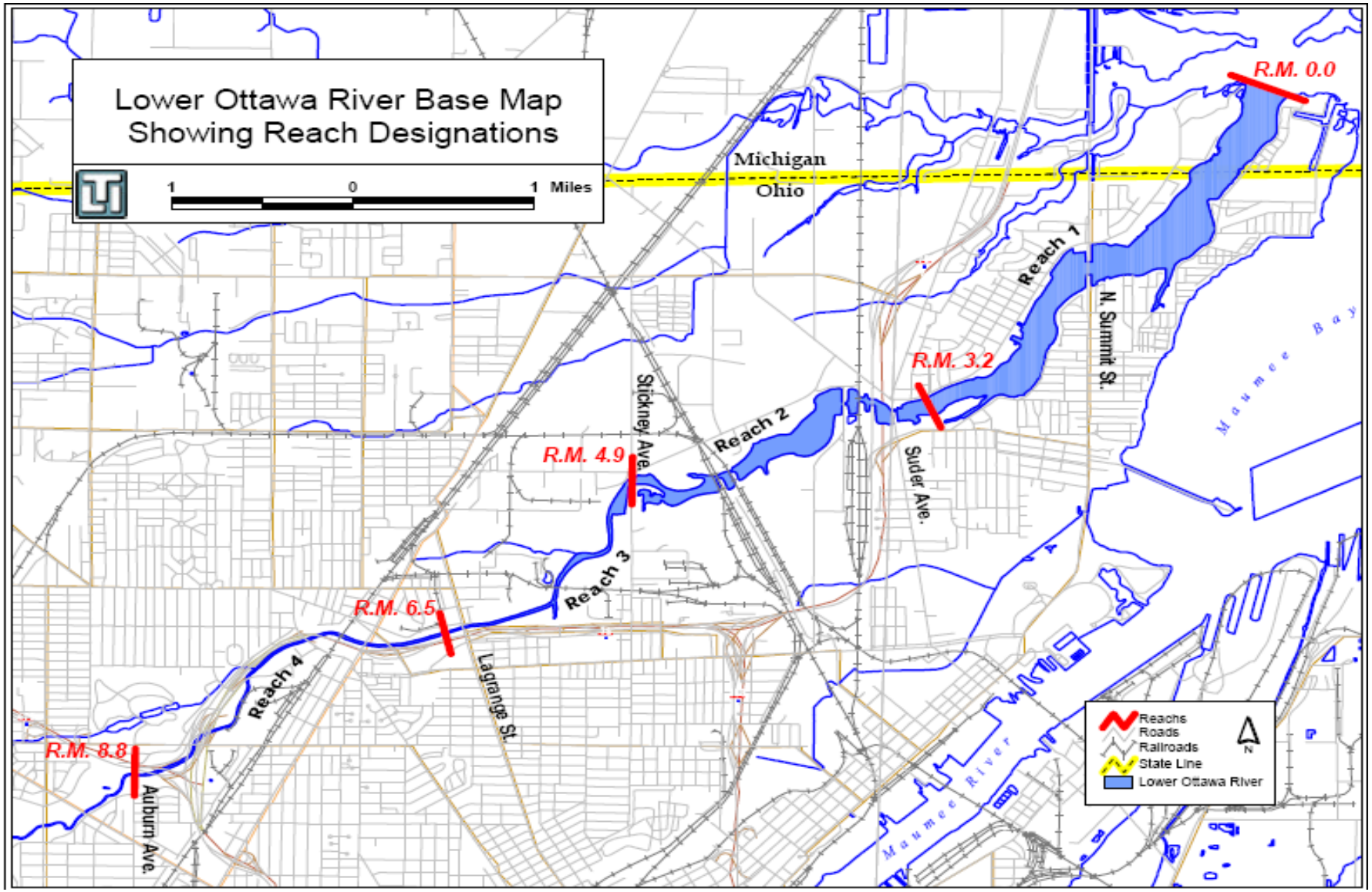
Great Lakes Legacy Act project partners

- Federal: USEPA GLNPO
- Non-Federal: Ottawa River Group

Project coordination team members

- USEPA Region 5
- Ohio EPA
- City of Toledo
- US Fish & Wildlife

Site Overview



Site Overview

- Highly channelized
- Narrow and flashy upstream of RM 4.9
- Broadens and slows downstream of RM 4.9 to the mouth
- Shallow and estuarine
  - Several places <3’ of water depth
- Highly industrialized (historically)
  - Superfund cleanups
  - RCRA corrective actions
  - TSCA sediment actions
  - NRDA actions

Objectives of Remediation

- Drivers of remediation
  - Restrictions on fish and wildlife consumption
  - Degradation of benthos
  - Fish tumors or other deformities

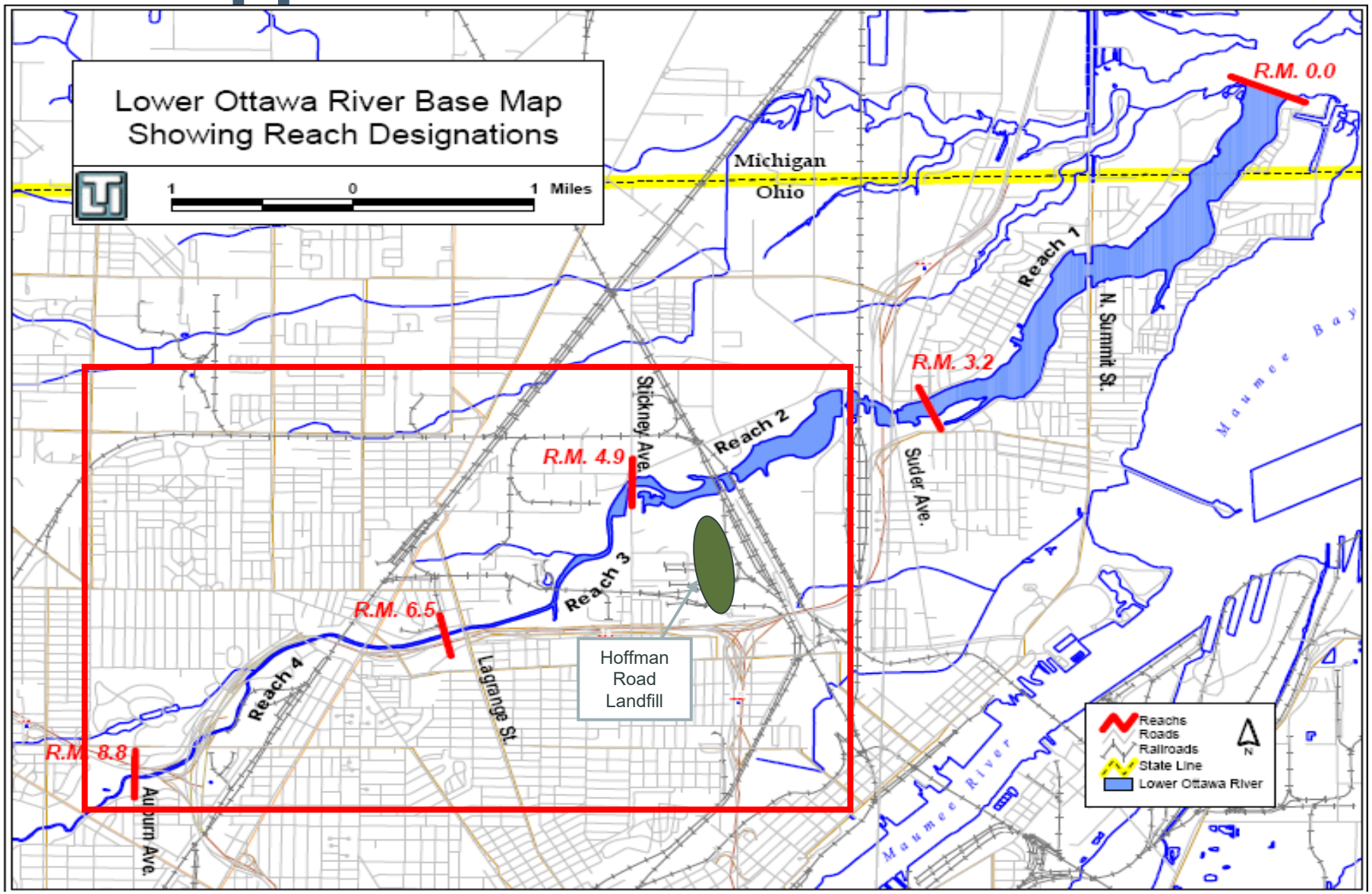
Objectives of Remediation

- Immediate post-dredging surface-weighted average concentration (SWAC) goals
    - PCBs: 1.5 ppm
    - PAHs: 30 ppm
    - Pb: 180 ppm
- Long-term SWAC goals
    - PCBs: 0.5 ppm
    - PAHs: 22.8 ppm
    - Pb: 128 ppm

Remedial Approach

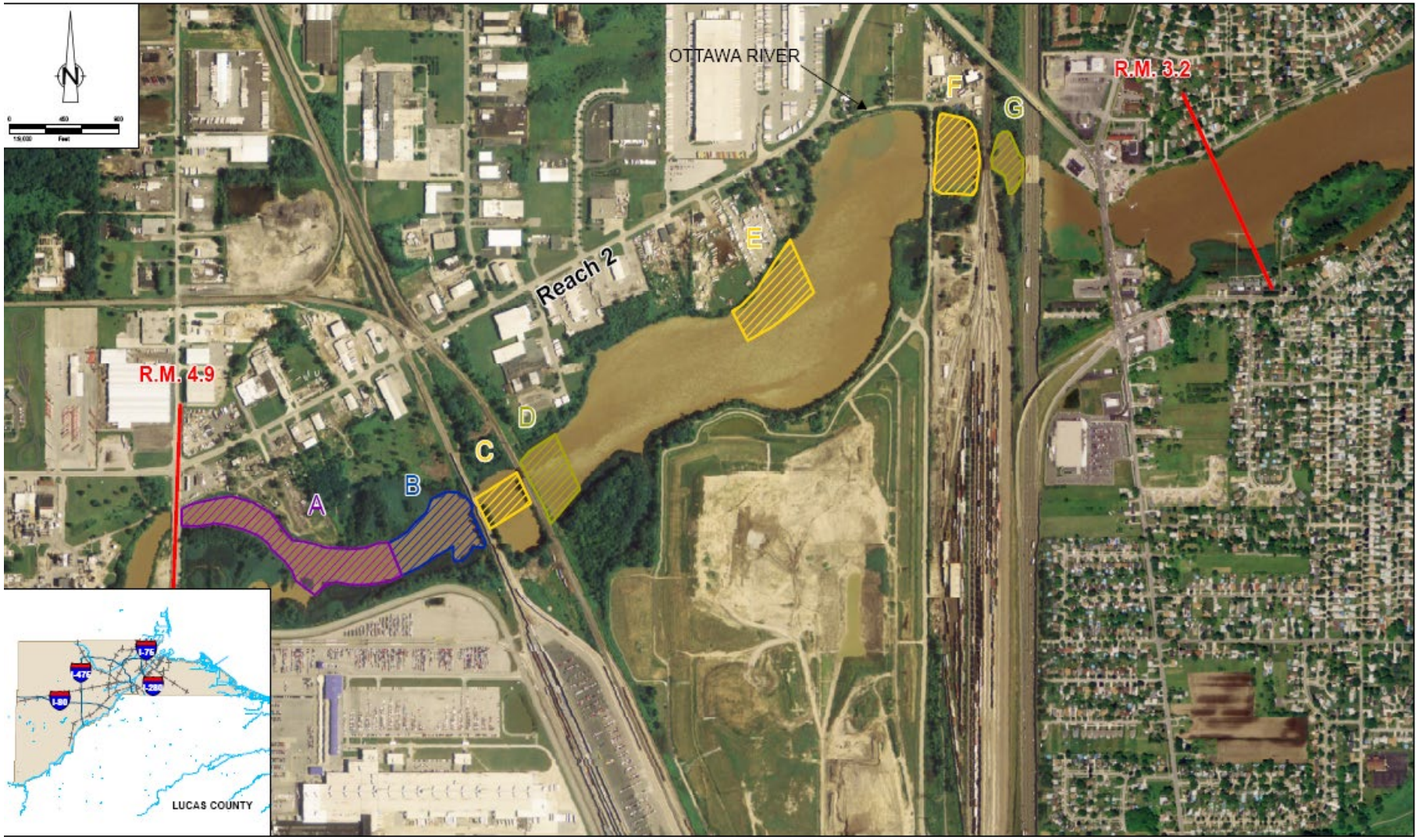
- Dredging + MNR
- Target larger sediment deposits
  - Approach contrasts with Ashtabula
- Focus on higher concentrations
  - Upstream of RM 3.2
- MNR expected to be final remedy for site
  - Estimated 10 years of MNR
- Monitoring a very important part of the MNR approach
  - Need for adaptive management?

Remedial Approach

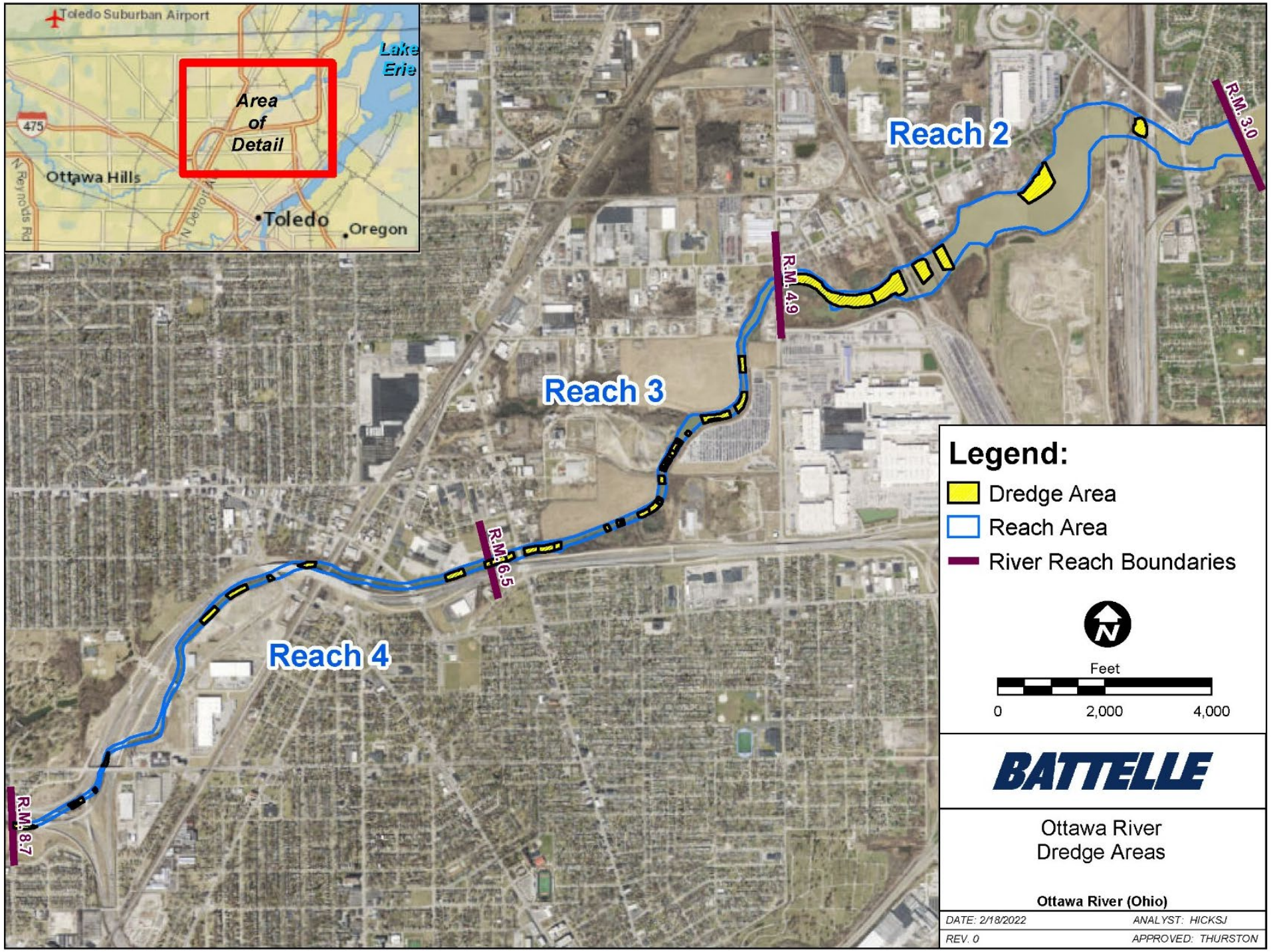


Remedial Approach

Remedial Approach



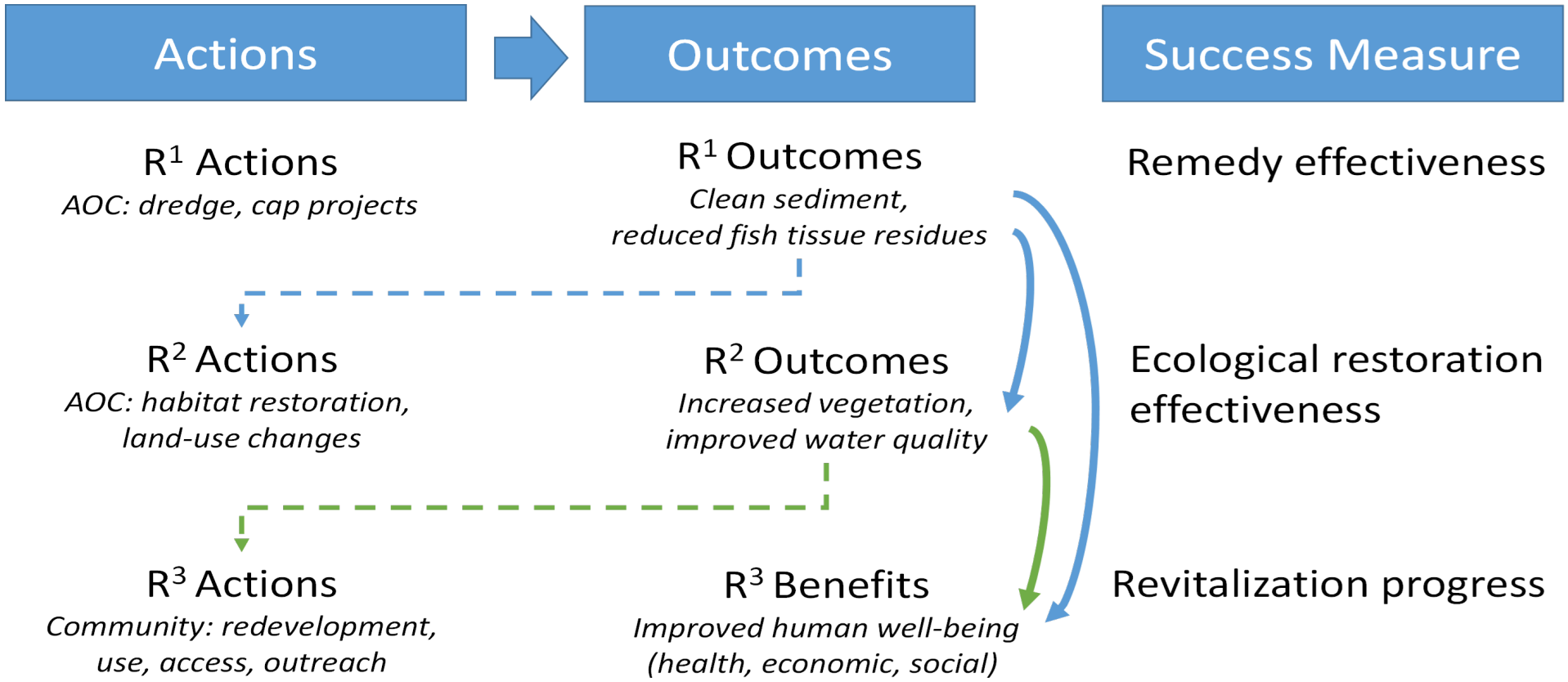
Ottawa River DMUs



Summary of Completed Early or Final Remedy

- Early actions / source control
  - Discharge permitting
  - CSO reductions
  - Superfund/RCRA cleanups
  - TSCA cleanup at unnamed tributary/Fraleigh Creek
  - Sibley Creek cleanup
  - Identification and tracking of upstream PCB source
  - Oil discharge from surface water outfall during remediation

Remediation to Restoration to Revitalization "R2R2R"

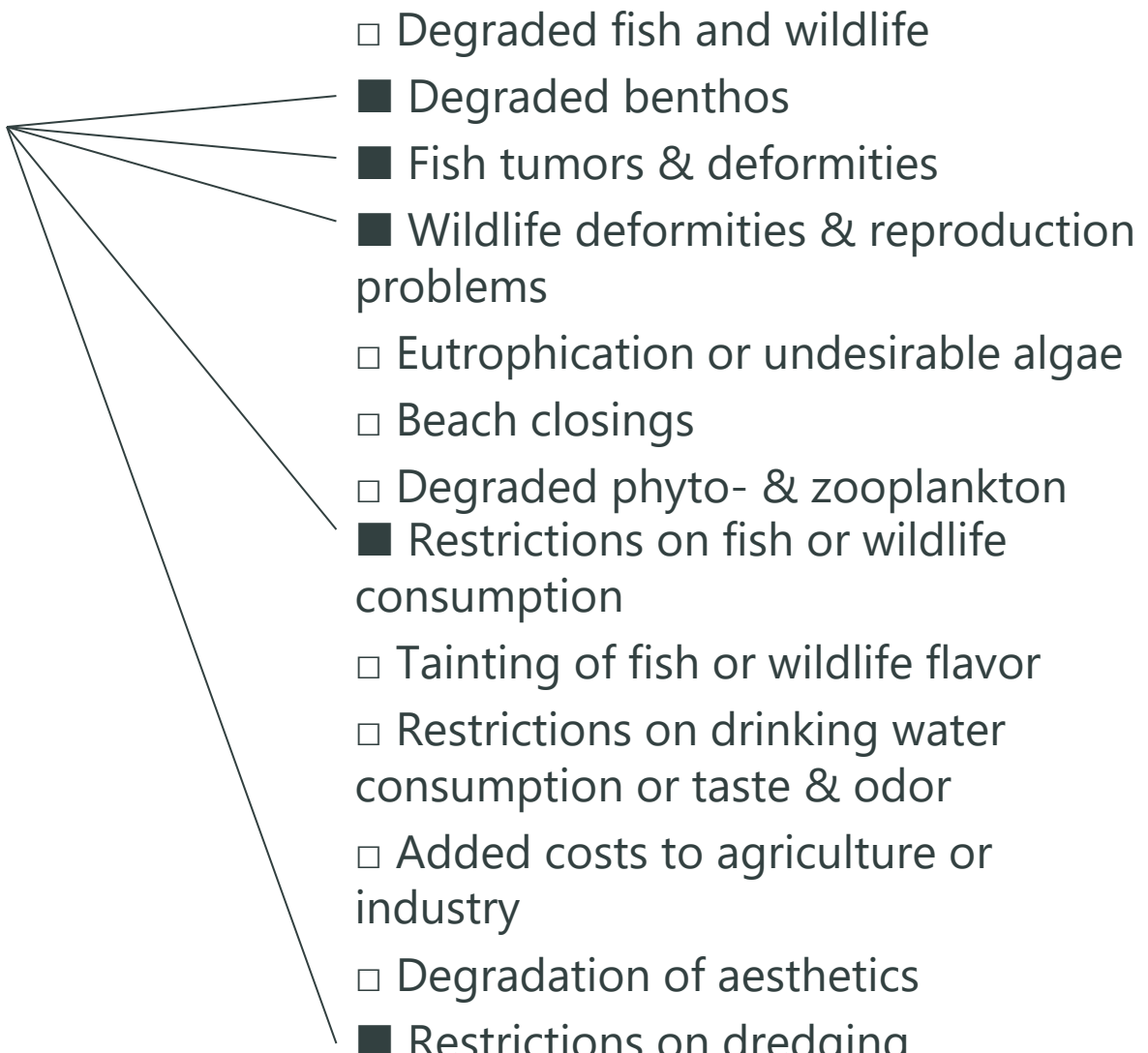


Remedial Project Goals (RPGs)

- Well defined objectives for remediation projects
- Often interrelated and span different environmental attributes
- Help with prioritizing remedy actions
- Six generalized RPGs applicable to many AOCs

RPGs & BUIs

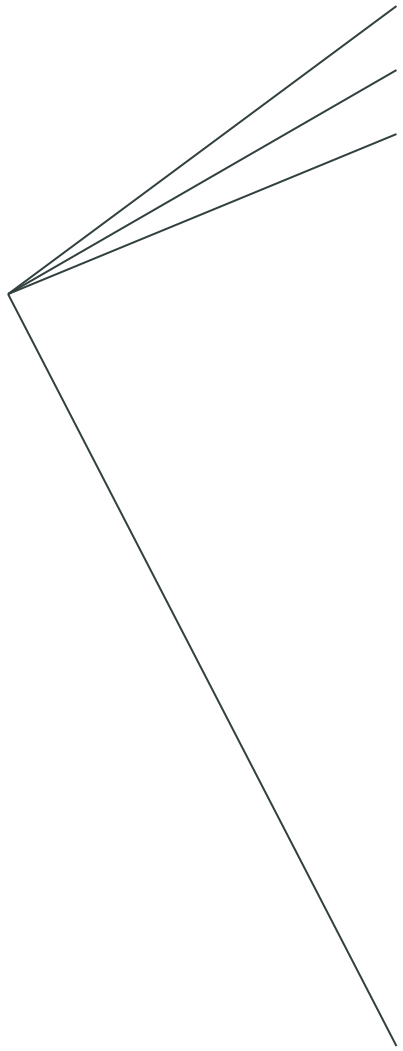
1. Reductions in sediment contaminants



RPGs & BUIs

1. Reductions in sediment contaminants

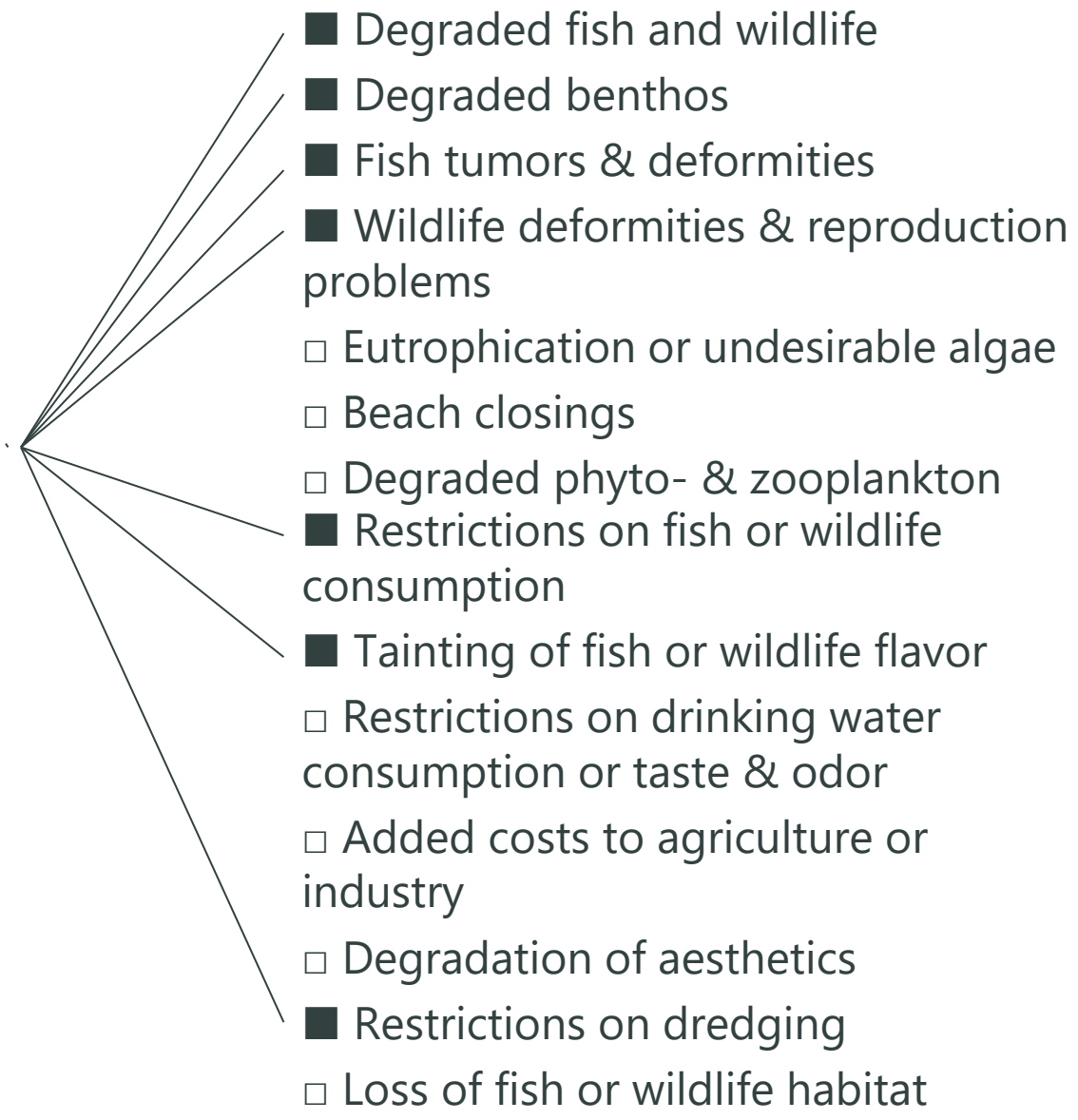
2. Benthic improvement



■ Degraded fish and wildlife
■ Degraded benthos
■ Fish tumors & deformities
□ Wildlife deformities & reproduction problems
□ Eutrophication or undesirable algae
□ Beach closings
□ Degraded phyto- & zooplankton
□ Restrictions on fish or wildlife consumption
□ Tainting of fish or wildlife flavor
□ Restrictions on drinking water consumption or taste & odor
□ Added costs to agriculture or industry
□ Degradation of aesthetics
■ Restrictions on dredging
□ Loss of fish or wildlife habitat

RPGs & BUIs

1. Reductions in sediment contaminants
2. Benthic improvement
3. Reductions in contaminants in biota



RPGs & BUIs

1. Reductions in sediment contaminants
2. Benthic improvement
3. Reductions in contaminants in biota
4. Reductions in sediment toxicity

■ Degraded fish and wildlife
■ Degraded benthos
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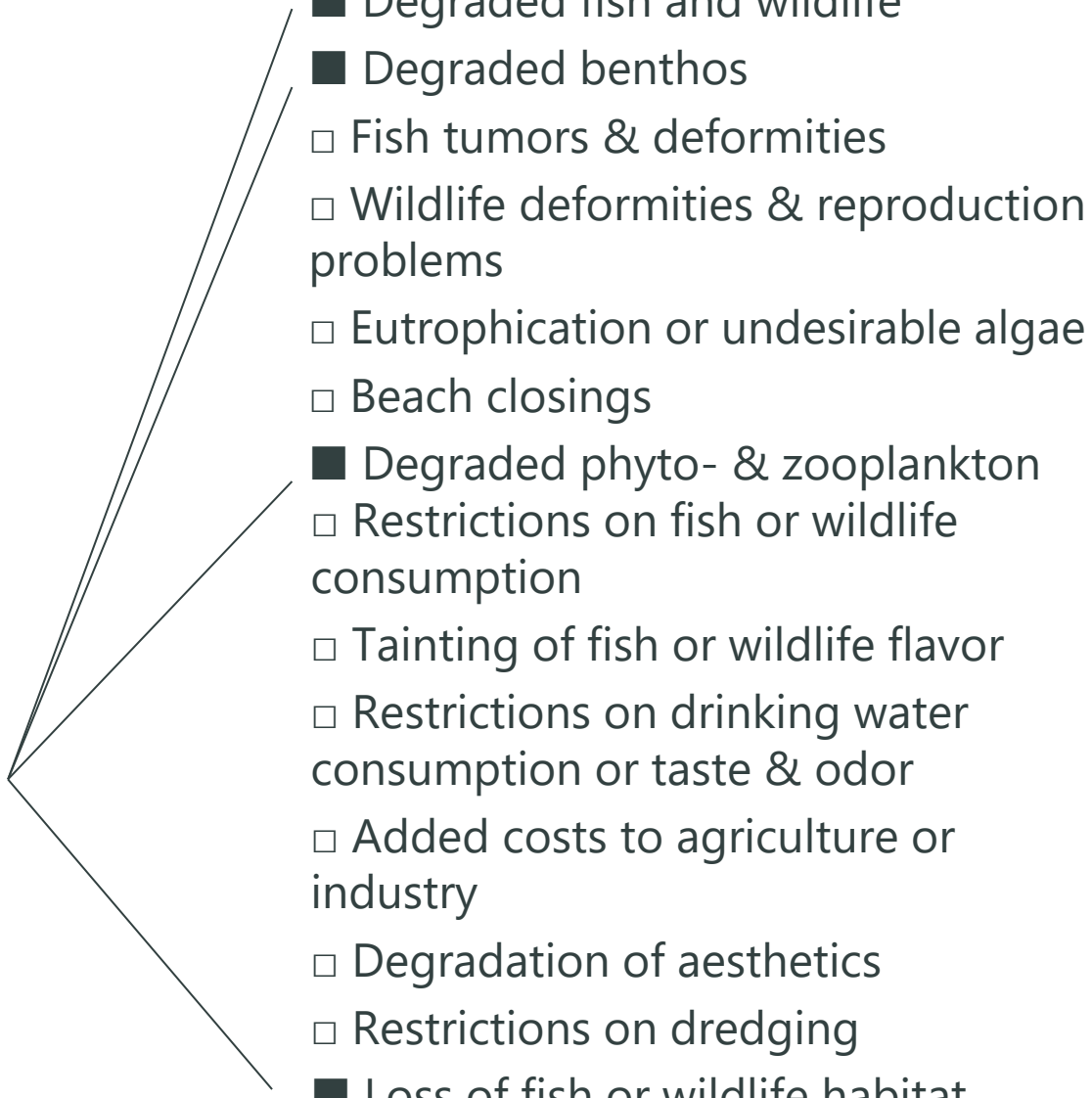
RPGs & BUIs

1. Reductions in sediment contaminants
2. Benthic improvement
3. Reductions in contaminants in biota
4. Reductions in sediment toxicity
5. Improvements in habitat quality



RPGs & BUIs

1. Reductions in sediment contaminants
2. Benthic improvement
3. Reductions in contaminants in biota
4. Reductions in sediment toxicity
5. Improvements in habitat quality
6. Volume/area of remediated sediment

■ Degraded fish and wildlife
■ Degraded benthos
□ Fish tumors & deformities
□ Wildlife deformities & reproduction problems
□ Eutrophication or undesirable algae
□ Beach closings
□ Degraded phyto- & zooplankton
□ Restrictions on fish or wildlife consumption
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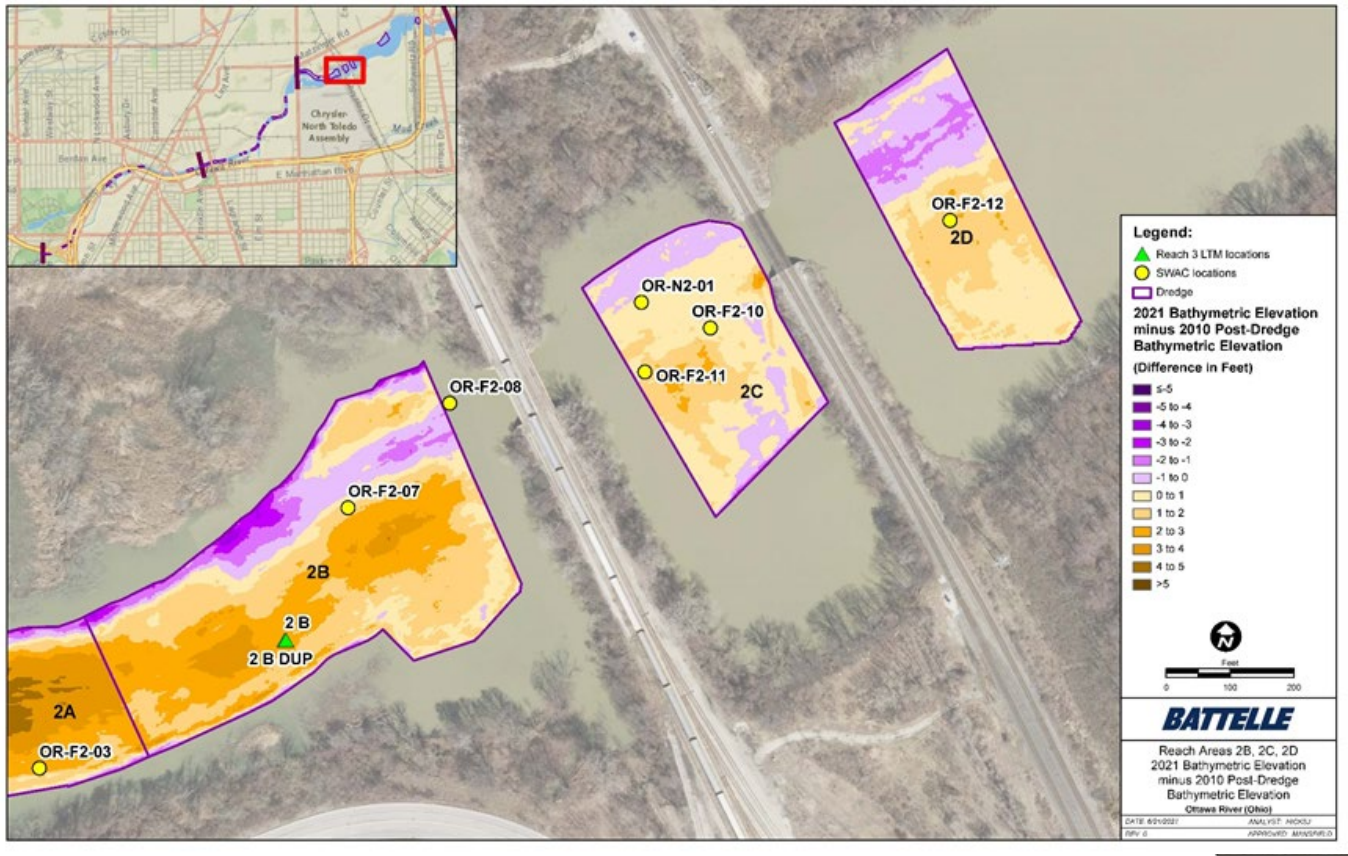
Remedy Effectiveness Assessment (REA) Using a Weight of Evidence Approach

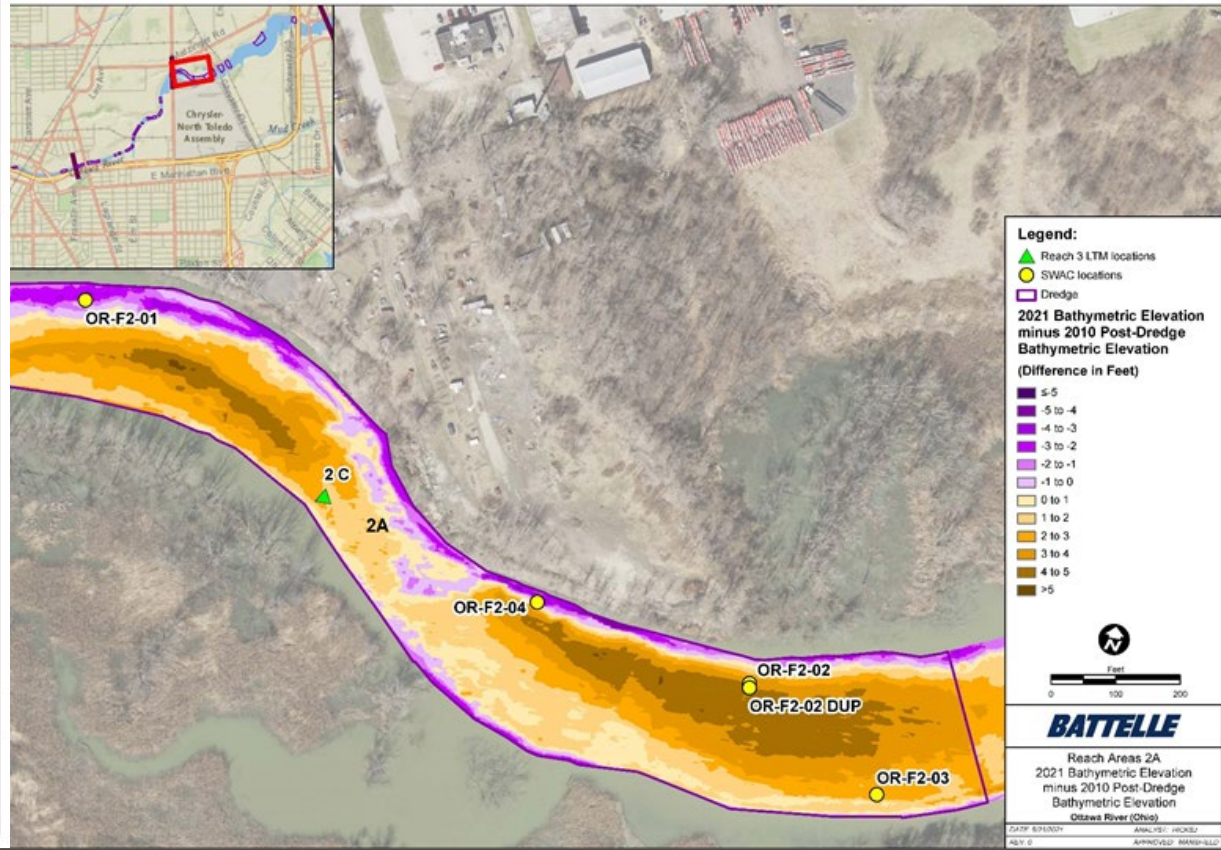
- Utilized multiple lines of evidence to assess the remedy
- Engaged multiple agencies and stakeholders to collect and synthesize data from the project and the AOC

Phases of the Project	Pre	During	Post (1)	LTM (2)	LTM (3)	LTM (5)	LTM (10)
Study periods	2009	2010	2011	2012	2013	2015	2020
Physical LOEs							
Bathymetry and Remediated Sediment Volume	Yes	-	Yes	-	-	-	Yes [5]
Ecological Assessment	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Qualitative Habitat Evaluation Index (QHEI)	Yes [1]	-	-	-	-	Yes	Yes
Biological LOEs							
Lacustuary Invertebrate Community Index (L-ICI) and Community Measures for Macroinvertebrates	Yes [2]	Yes	Yes	Yes	Yes	Yes	Yes
Toxicity Testing – Chironomus dilutus and Hyalella azteca	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Index of Biotic Integrity (IBI) and Modified Index of well-being (MIwB)	Yes [3]	-	-	-	-	Yes	Yes
Fish Tumors and Anomalies (deformities, fin erosions, lesions/ulcers, and tumors [% DELT])	Yes [3]	-	-	-	-	Yes	Yes
Sport Fish Tissue Consumption Advisory	-	-	-	-	-	Yes	-
Chemical LOEs							
Contaminants in Surface Sediment	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sediment Characteristics – Bulk Density and Moisture	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Particle Size Distribution (PSD) Data	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Surface Sediment Metals and Acid Volatile Sulfides/Simultaneously Extractable Metals (AVS/SEM)	Yes	-	-	-	-	Yes	Yes
Passive Samplers - Sediment[4]	Yes	-	Yes	-	-	-	Yes
Surface Weighted Average Concentration (SWAC)	Yes	-	-	-	-	Yes	Yes
Subsurface sediment cores- PAH and PCB Mass Estimates[6]	Yes	-	Yes	-	-	-	Yes
Contaminants in Water	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Direct Water Concentrations	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Passive Samplers in Water Column[4]	Yes	-	Yes	Yes	Yes	Yes	Yes
Porewater Concentrations	Yes	-	-	-	-	Yes	-
Contaminants in Tissue	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Contaminants in Macroinvertebrates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Contaminants in Fish Tissue	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Contaminants in Tetragnathidae Spiders	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Contaminants in Araneidae Spiders	-	-	Yes	-	-	-	-
Contaminants in Adult Terrestrial Insects	-	Yes	-	-	-	-	-
Contaminants in Basal Resources, Periphyton, and Coarse Particulate Organic Matter (CPOM)	Yes	-	-	-	-	-	-
Bioaccumulation assessment - Lumbriculus	Yes	-	-	-	-	Yes	Yes

Physical LOE – Bathymetric change

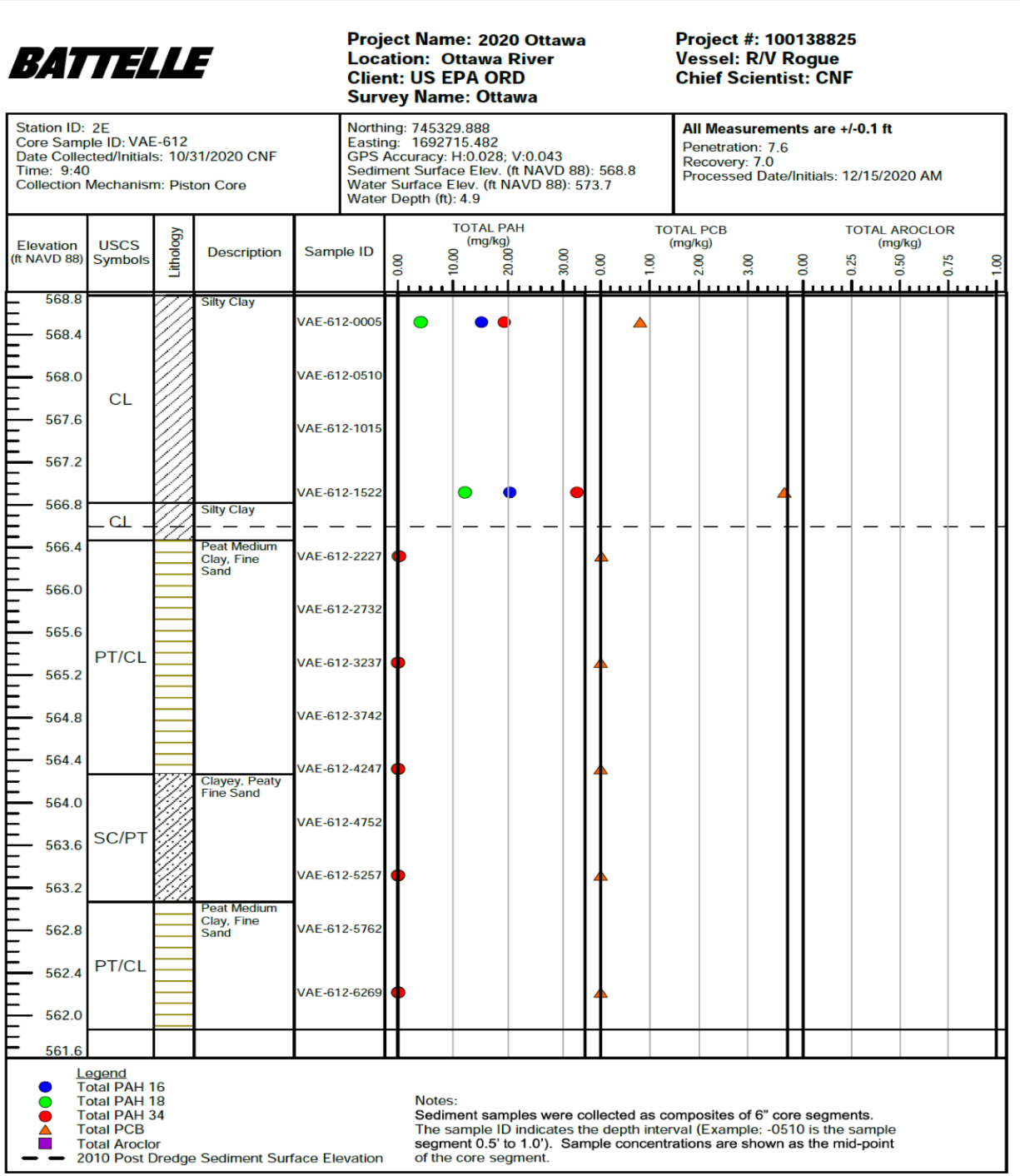
- Changes in bathymetry showed scour and depositional zones over time within DMUs

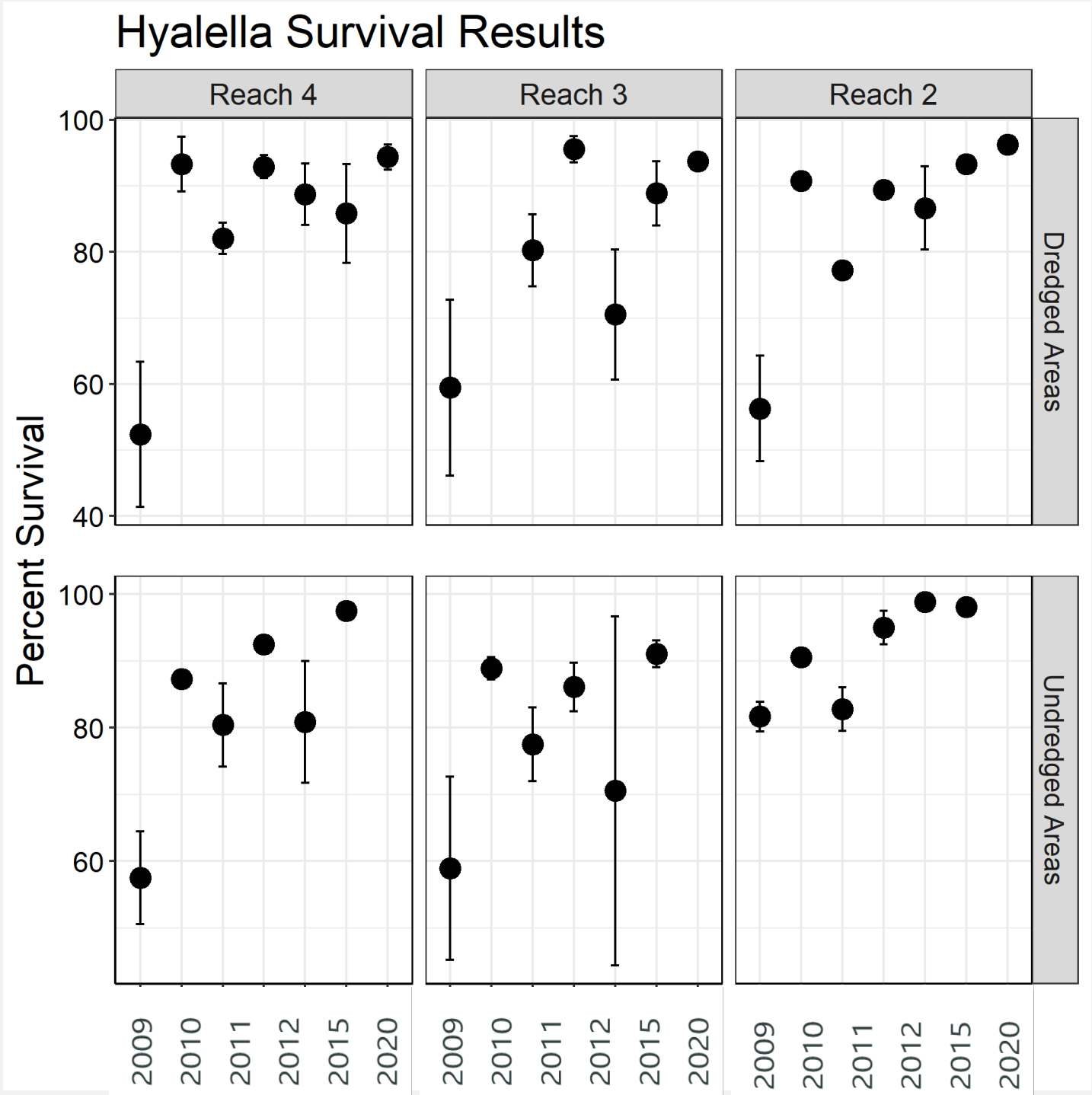




PHYSICAL LOE

- Core characterization showed the lithography of the sediment relative to the cut lines from the dredging
- This specific core shows deposition of silty clay sediments on top of the dredge cut from 2010 to 2020





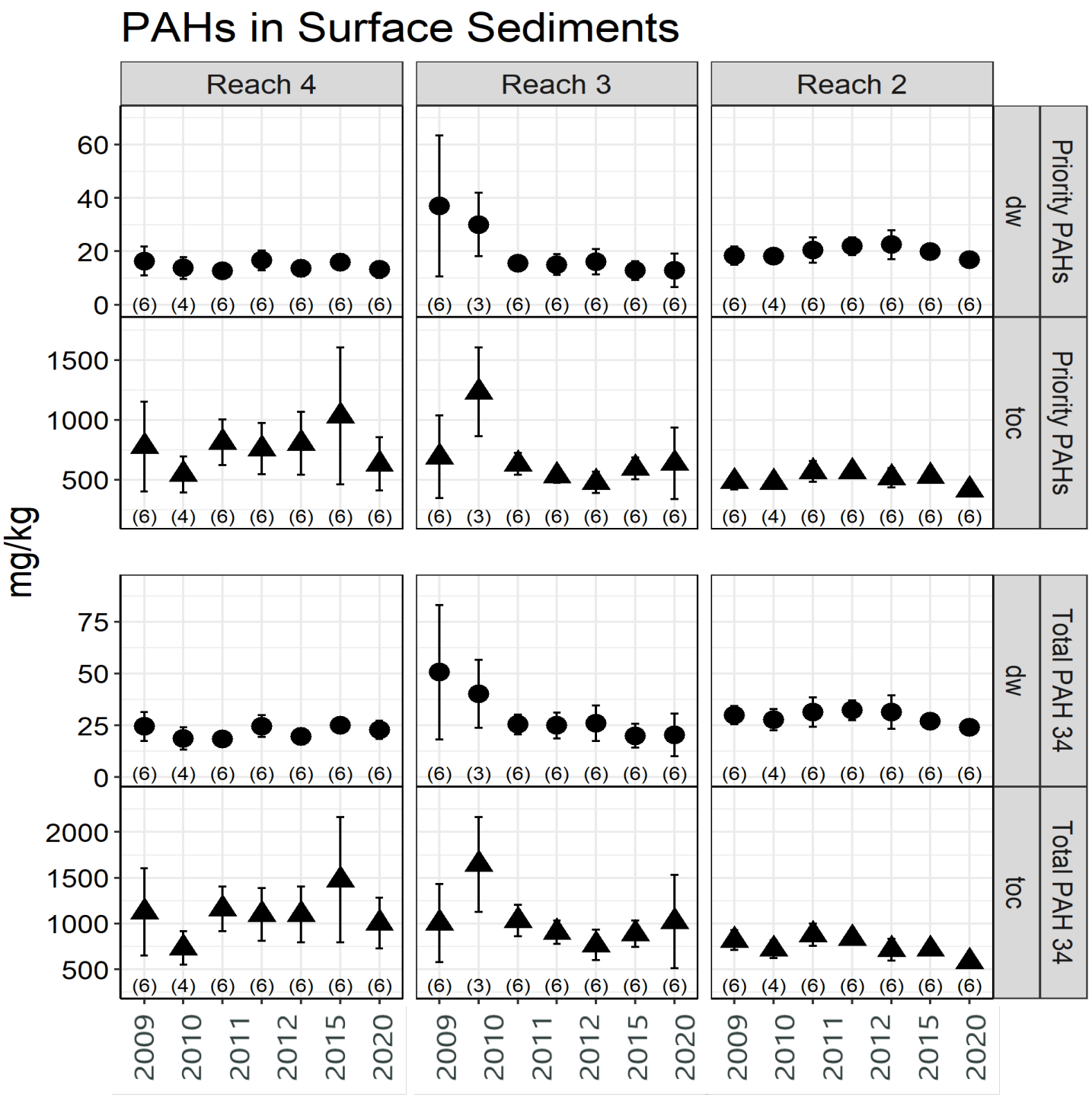
BIOLOGICAL LOE

- Toxicity – *Hyallela* survival assay
- Survival and growth* improved over time post remedy
- Similar results for the Chironomid assay

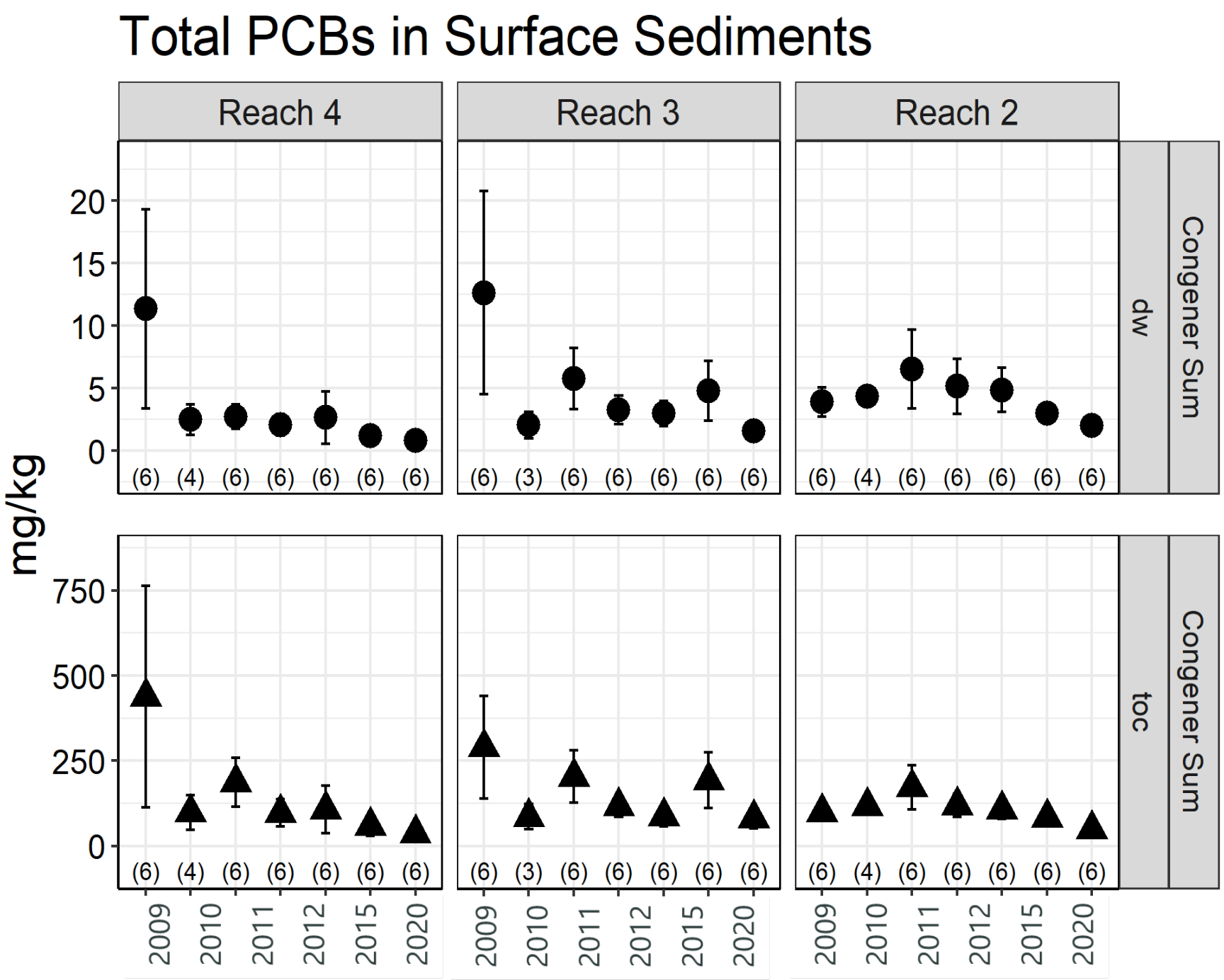
* Data not shown

CHEMICAL LOE

Total Priority PAH and Total PAH concentrations as dry weight and TOC-normalized in surface sediments



Mean ± Standard Error is shown Across Stations Within each Reach and Phase (Sample Size Shown in Parentheses)



CHEMICAL LOE

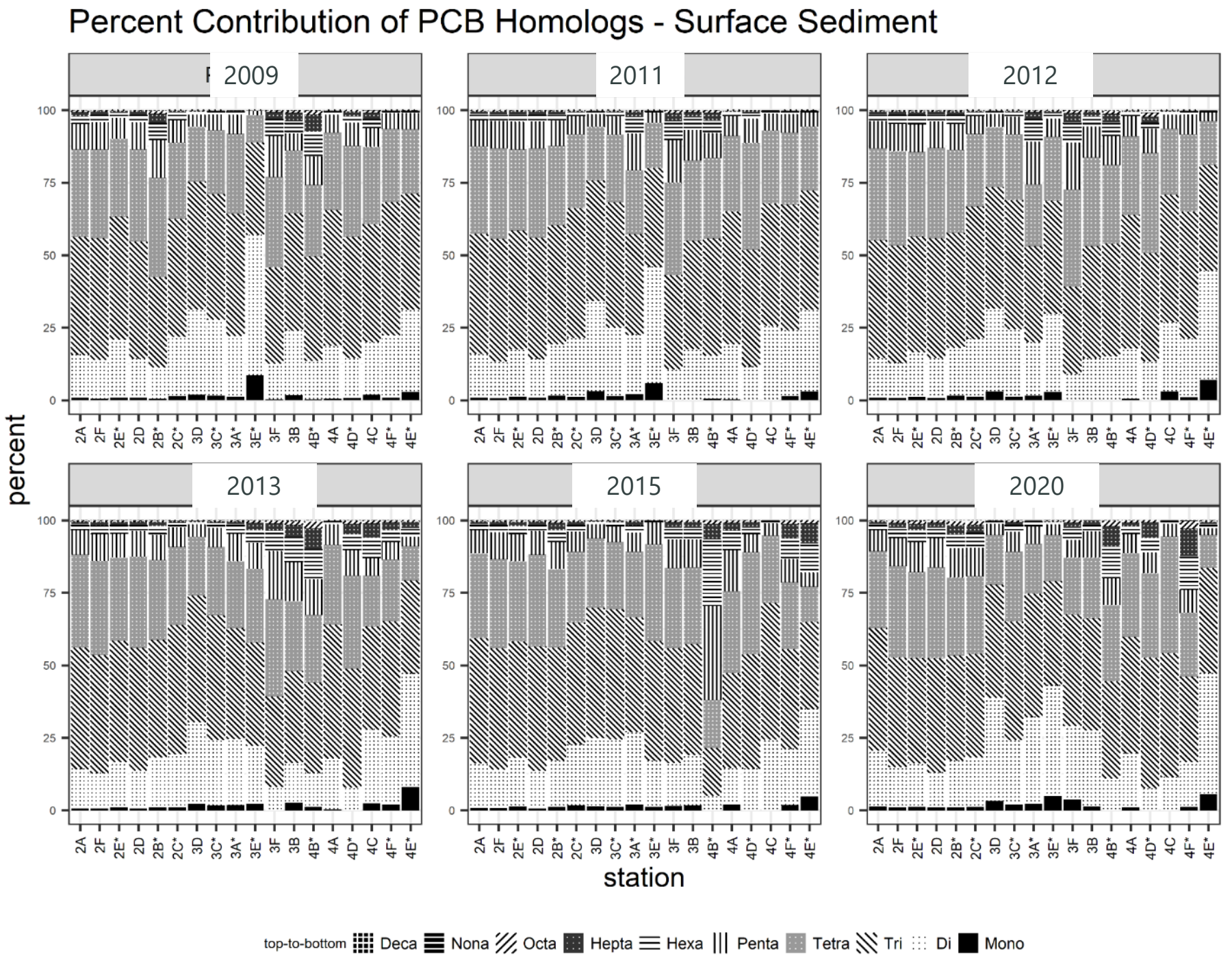
Total PCBs (sum of congeners) in surface sediments

Reported both as dry weight (dw) and organic carbon normalized (toc)

Mean ± Standard Error are Shown Across Stations Within each Reach and Phase (Sample Size Shown in Parentheses)

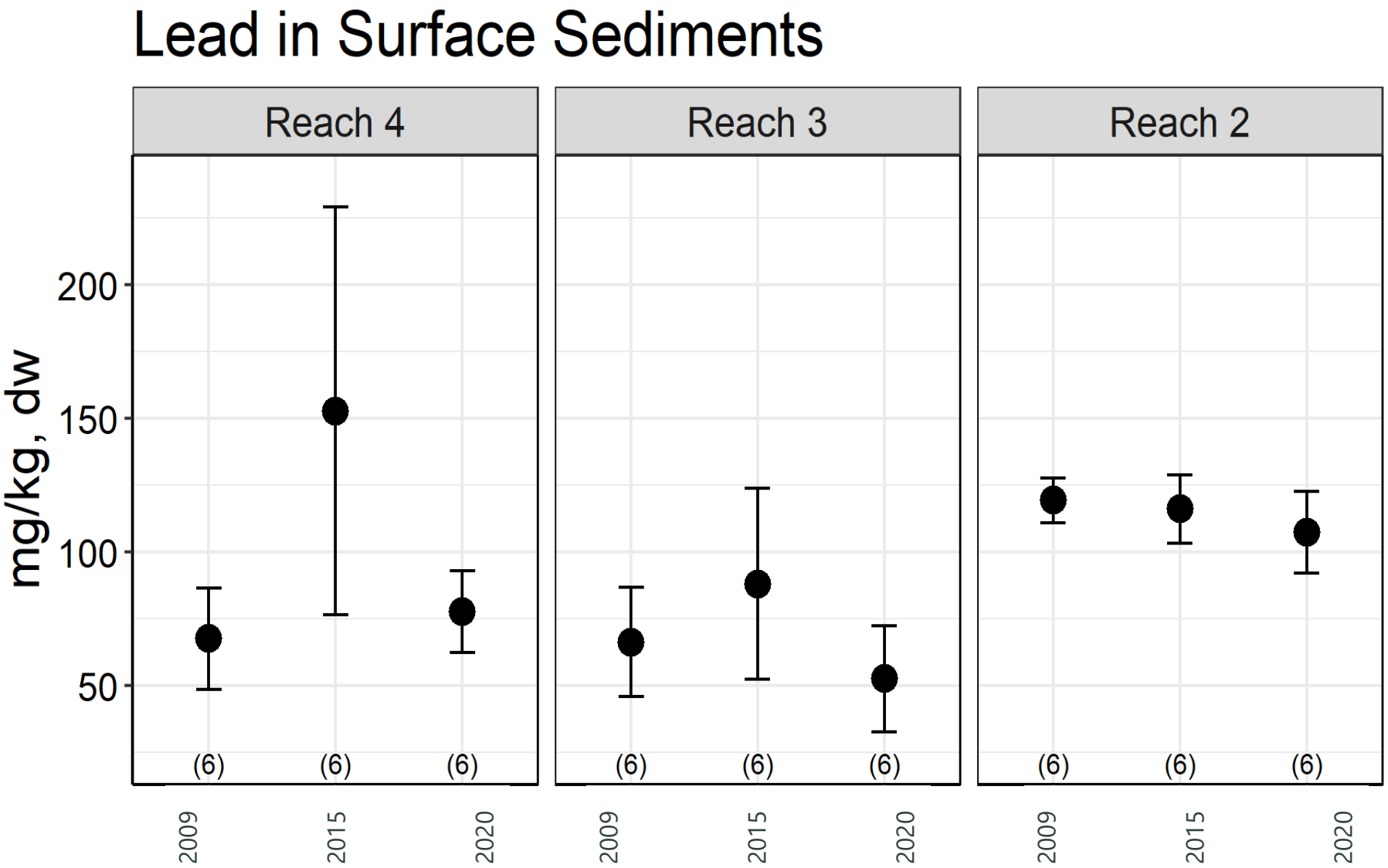
CHEMICAL LOE

Composition of Total PCB by homolog in surface sediment samples



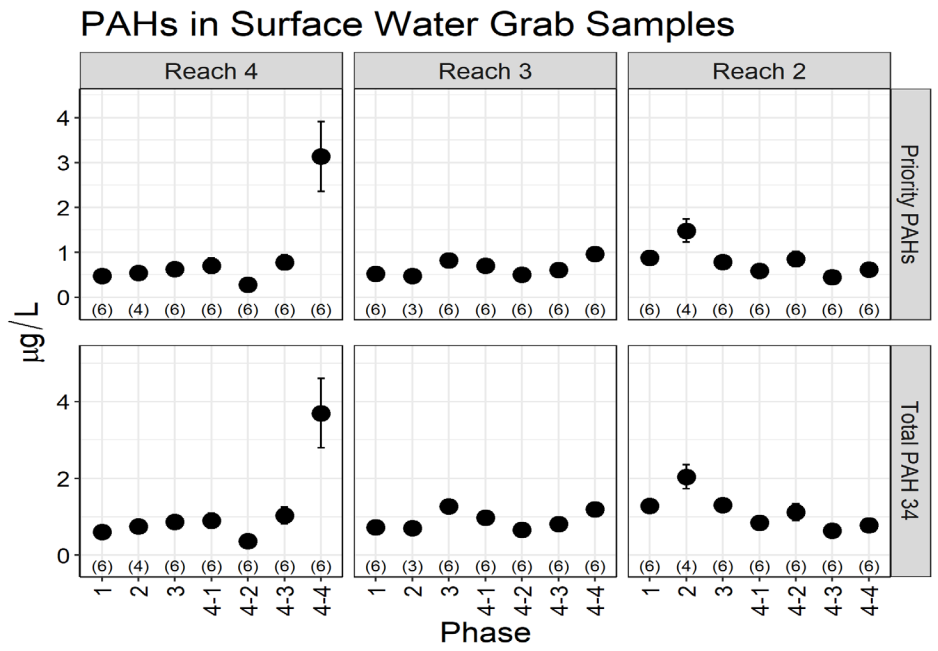
CHEMICAL LOE

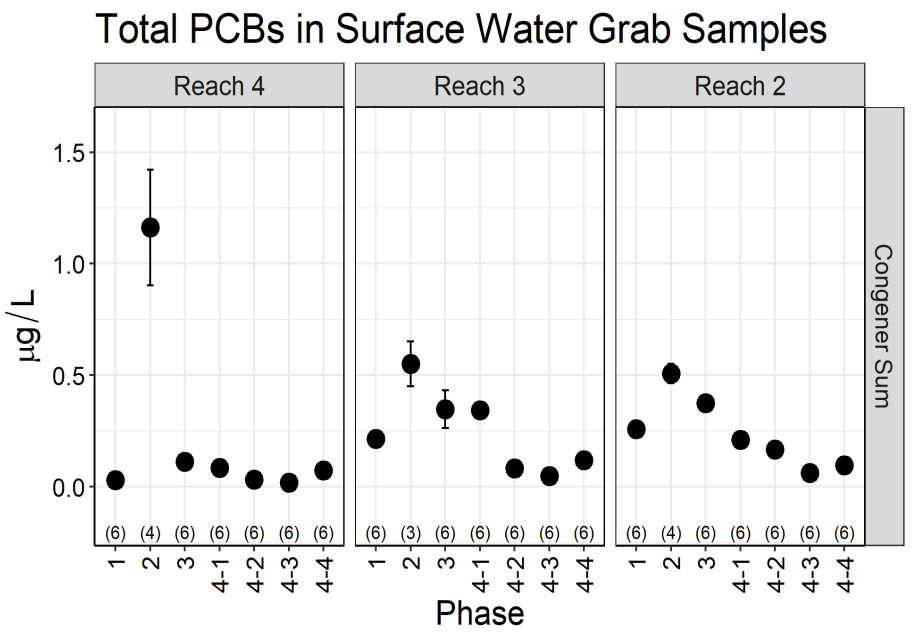
Lead concentrations in surface sediments



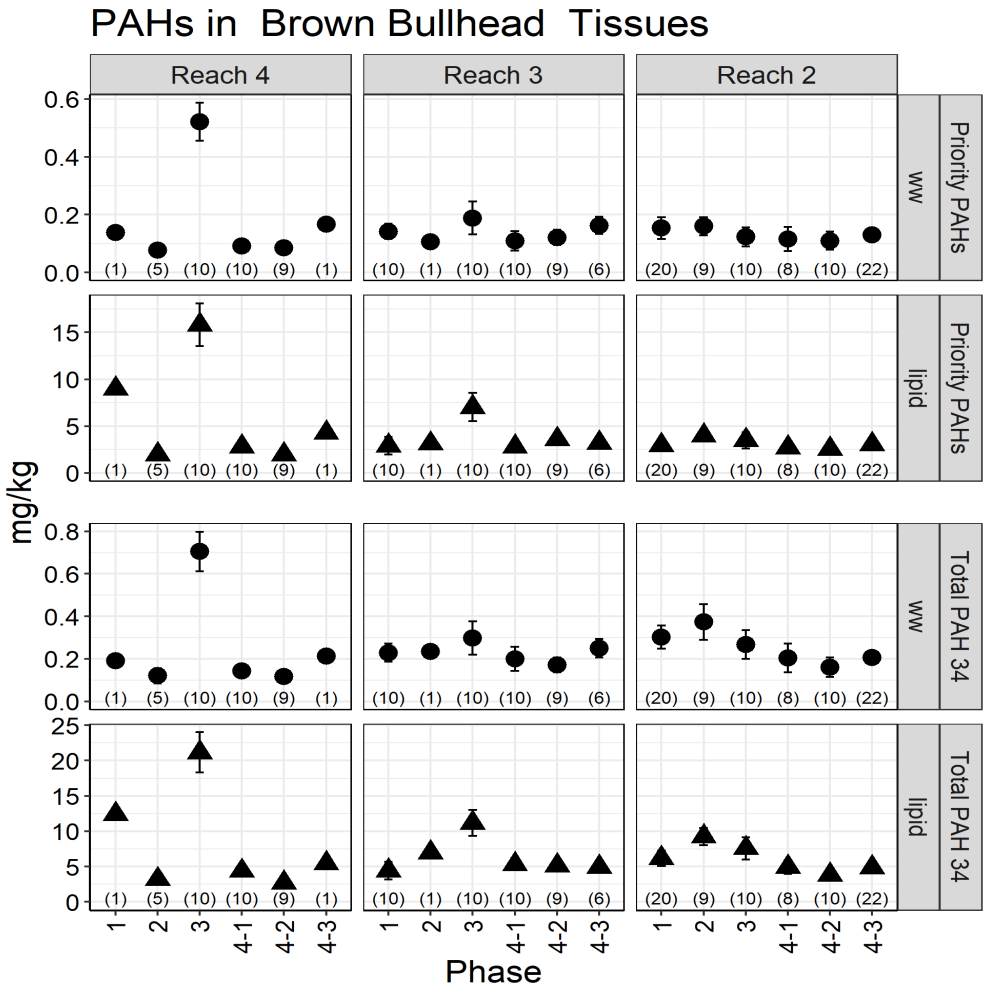
Mean ± SE are Shown Across Stations Within each Reach and Phase (Sample Size Shown in Parentheses)

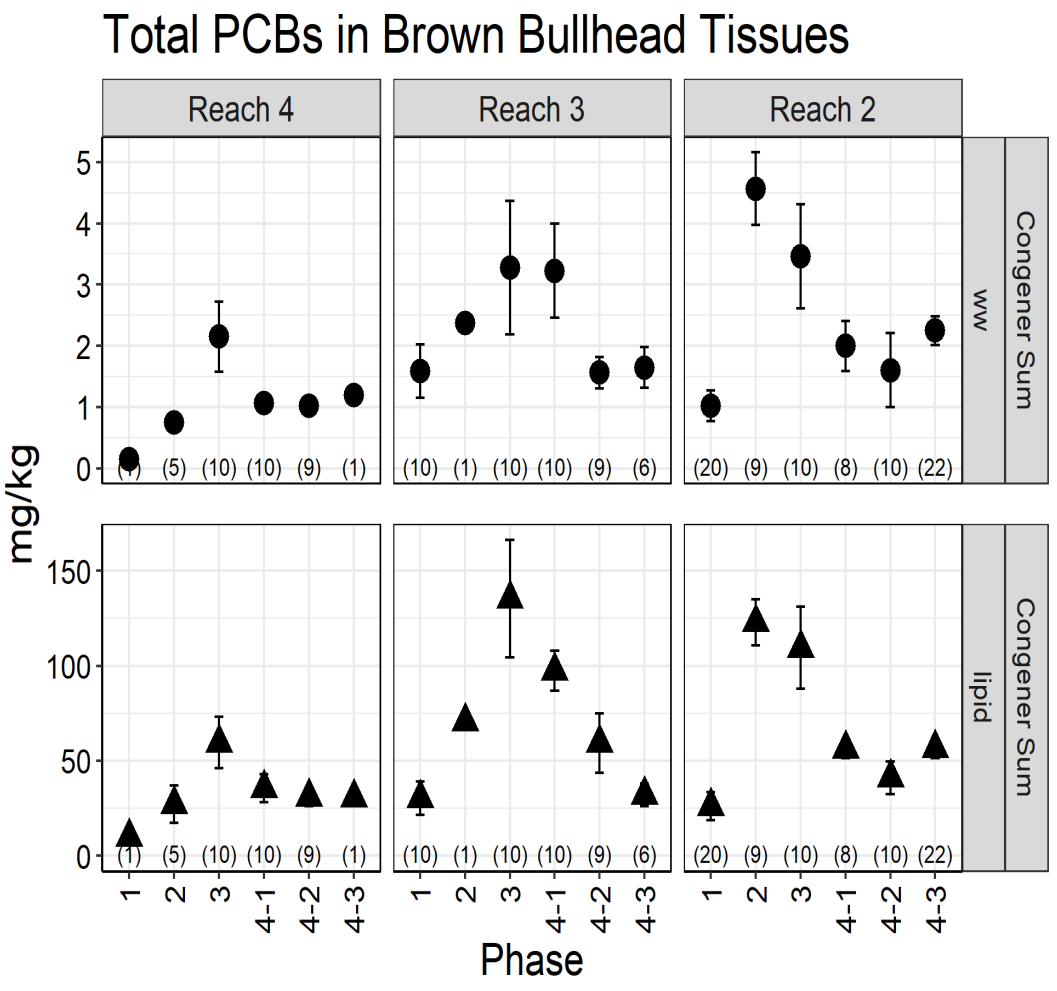
Water CoCs Over Time





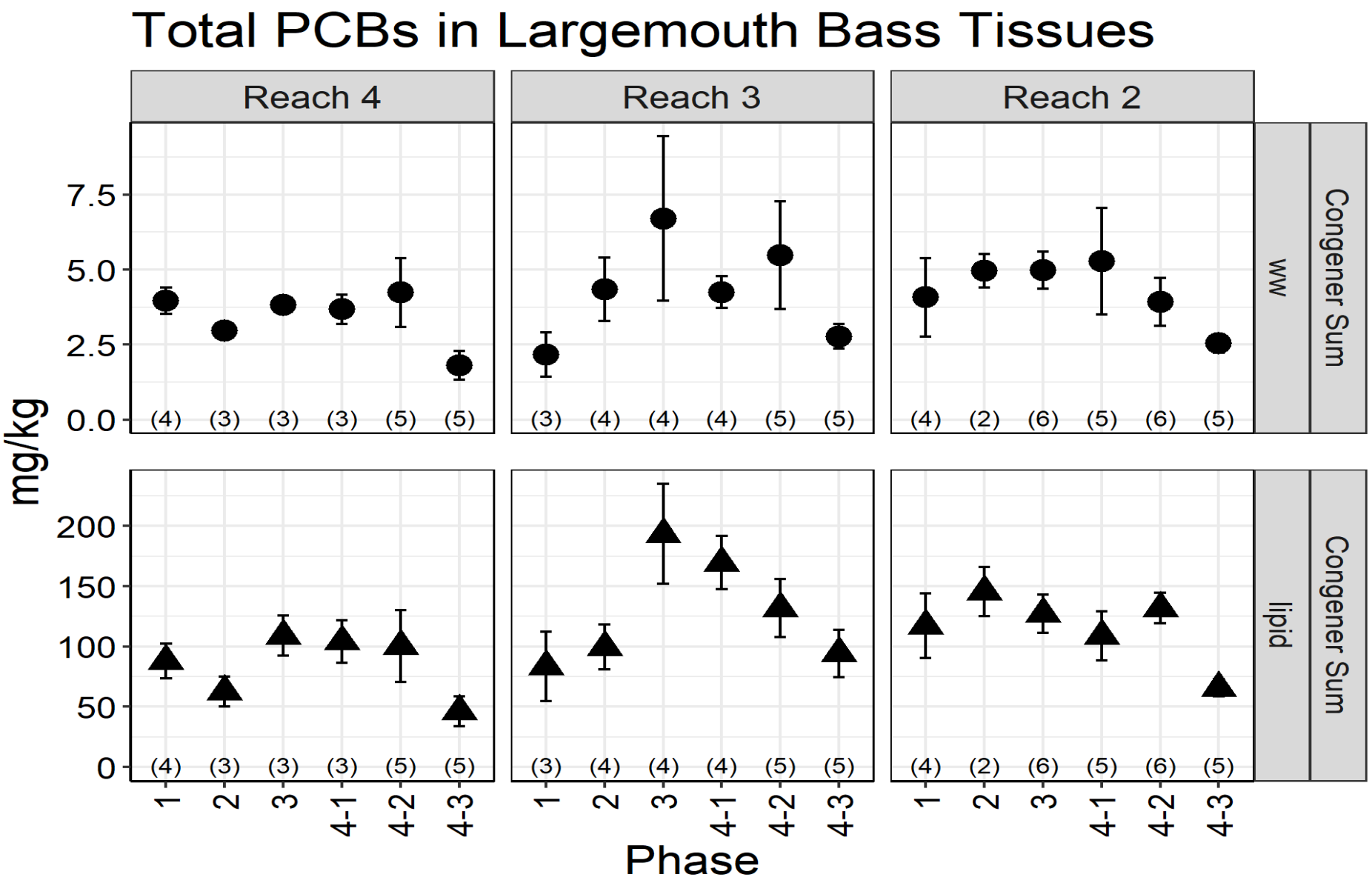
Brown Bullhead – CoCs in Tissue Samples





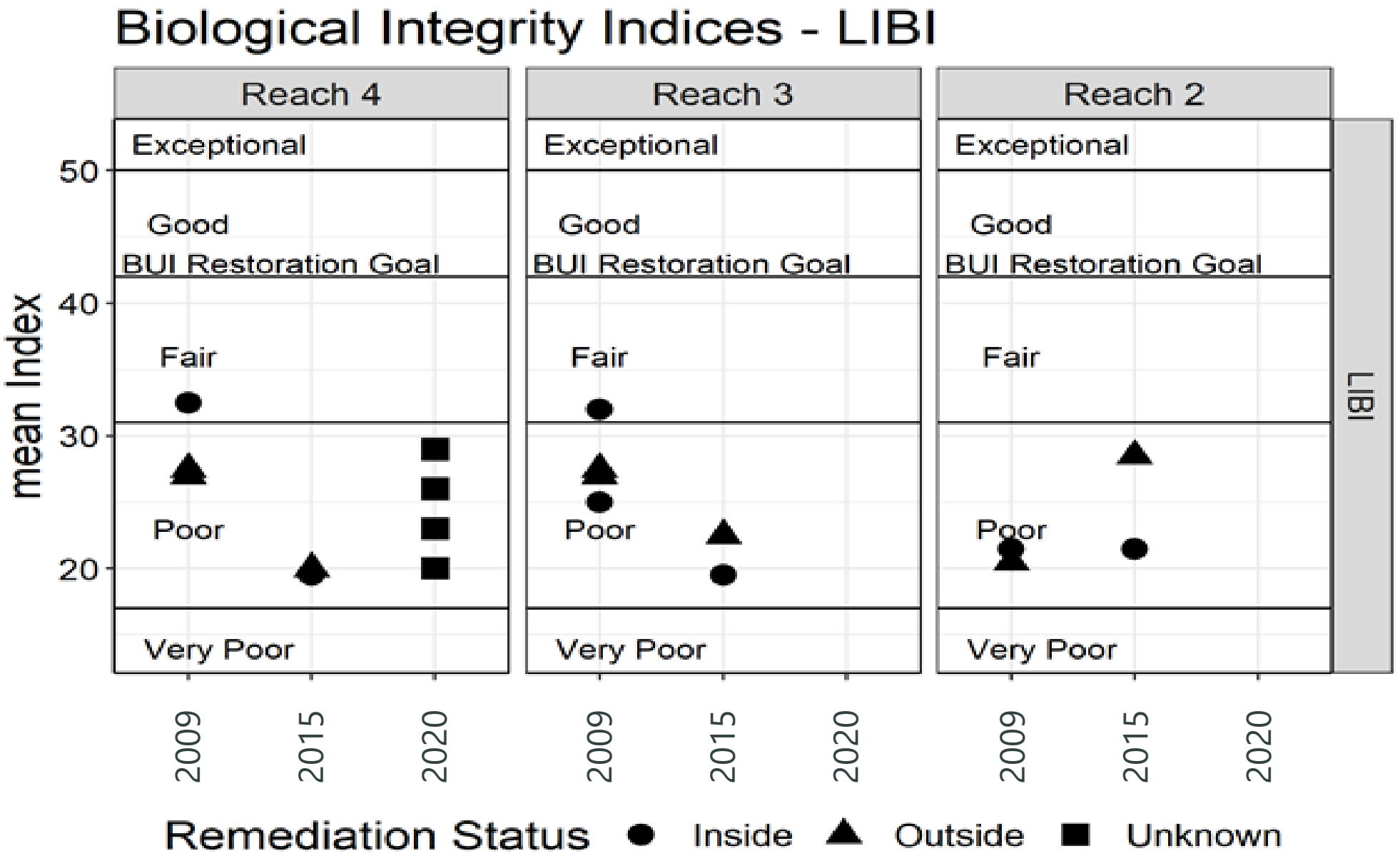
Mean ± Standard Error are Shown Across Stations Within Each Reach and Phase (Sample Counts are Shown in Parentheses for Each Group

Total PCB Congener Conc. in Largemouth Bass Tissue



Mean ± Standard Error are Shown Across Stations Within Each Reach and Phase (Sample Counts are Shown in Parentheses for Each

Index of Biological Integrity (IBI) for Fish Communities Averaged for Each Station in Each Reach by Phase



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

- Short-term goals
  - 1.5 ppm PCB SWAC
  - 30 ppm PAH SWAC
  - 180 ppm Pb SWAC
- Short-term achieved
  - 1.44 ppm PCB SWAC
  - 6 ppm PAH SWAC
  - 104 ppm Pb SWAC

Long-Term Objectives Achieved

- *Restrictions on Fish and Wildlife Consumption* - ***Removed 2022***
- *Degradation of Benthos*
- *Fish Tumors or Other Deformities*

Key Take-Home Messages

- Mass removal vs. comprehensive dredging approach
- Better delineation of contamination pre-dredging
- Time to make some adaptive management decisions