

A One Water Approach to Restoring Sheboygan River and its Legacy

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CH2M



Stacy Hron

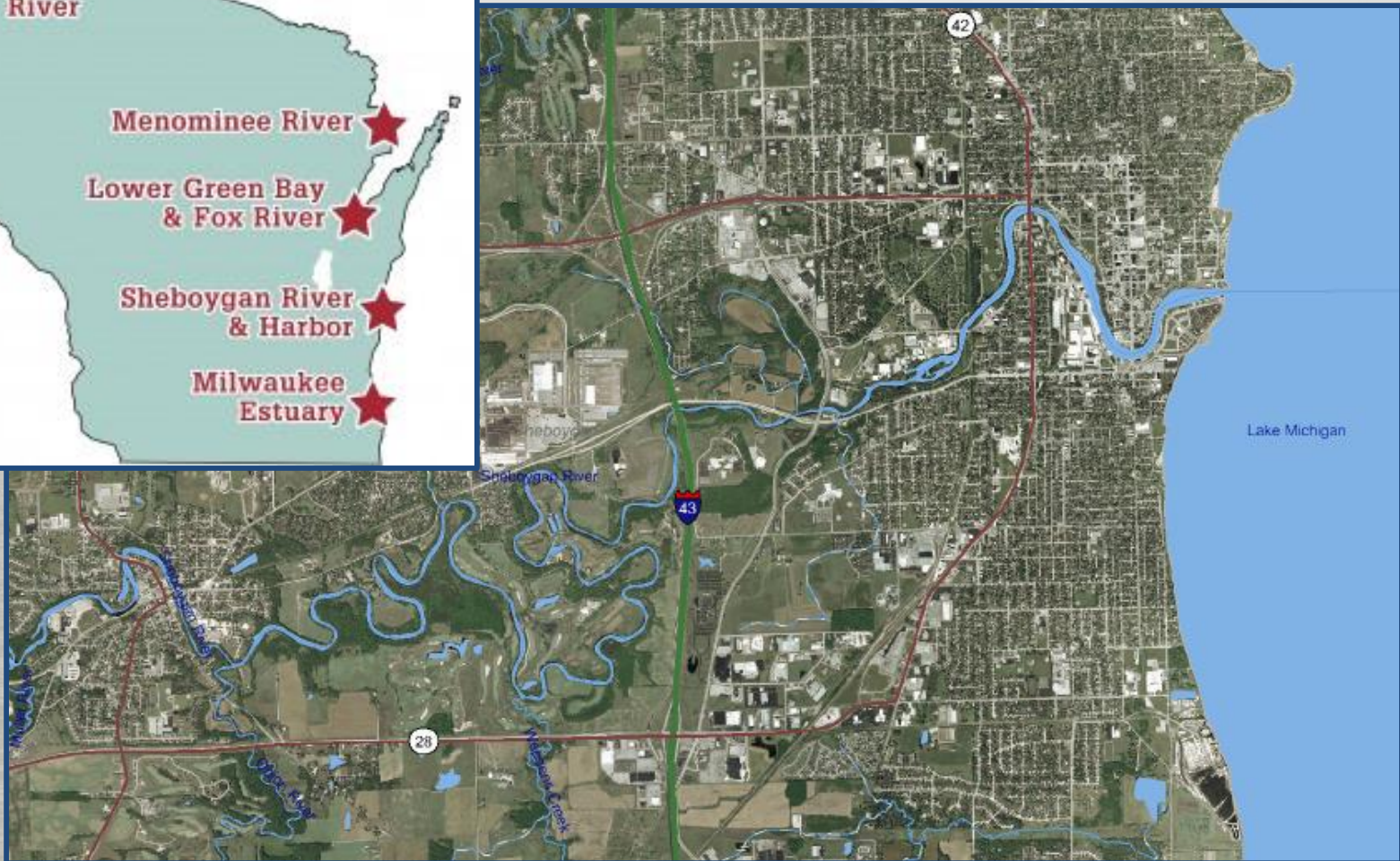
WI Dept. of Natural Resources



Wisconsin's Great Lakes Areas of Concern



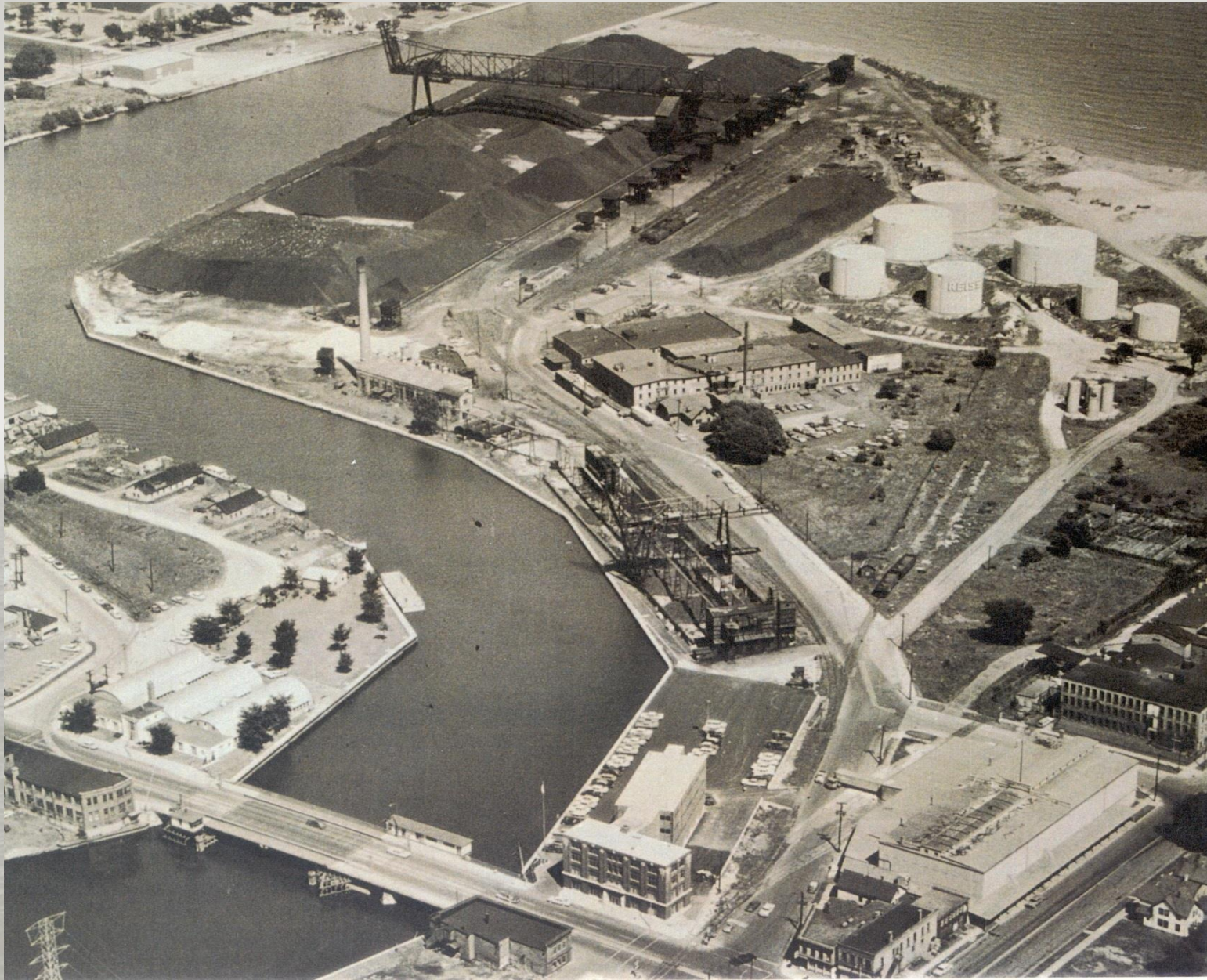
What is an AOC?



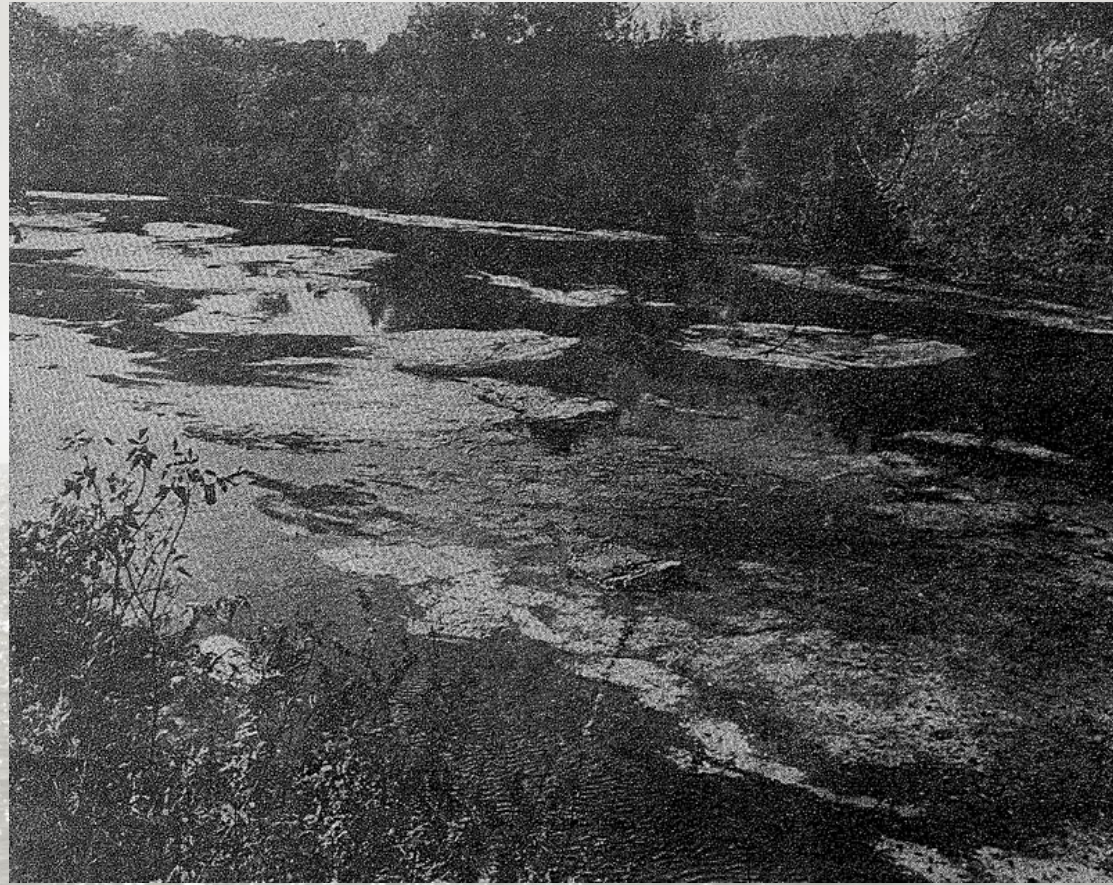
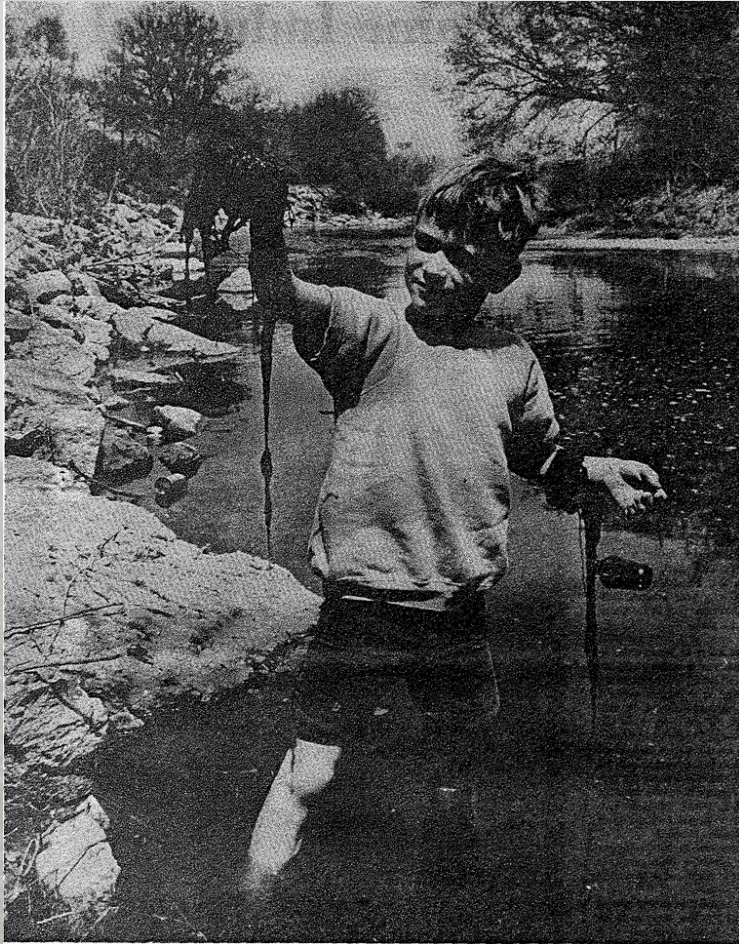
Why is the river an AOC?



Why is the river an AOC?



Why is the river an AOC?



Photos Courtesy of Sheboygan County Historical Research Center

Why is the river an AOC?



Photos by Stacy Hron, Deb Beyer, Scott Horzen



US Army Corps
of Engineers

Sheboygan Harbor

Navigation Project

Photos by Deb Beyer



Restoring an AOC

Dredging



Habitat Restoration



Monitoring/
Assessment



Photos by Stacy Hron, WDNR

Determining Management Actions

- Stakeholder Forums
 - Dredge Workgroup
 - Fish and Wildlife Technical Advisory Committee
- Very complex planning – overlapping projects and timeline driven



Engaging Stakeholders

Partnership– the key to success



Photos by Deb Beyer



All of the pieces falling into place

Superfund Projects were coordinated for dredging in 2011 & 2012 (~\$22.5 million)

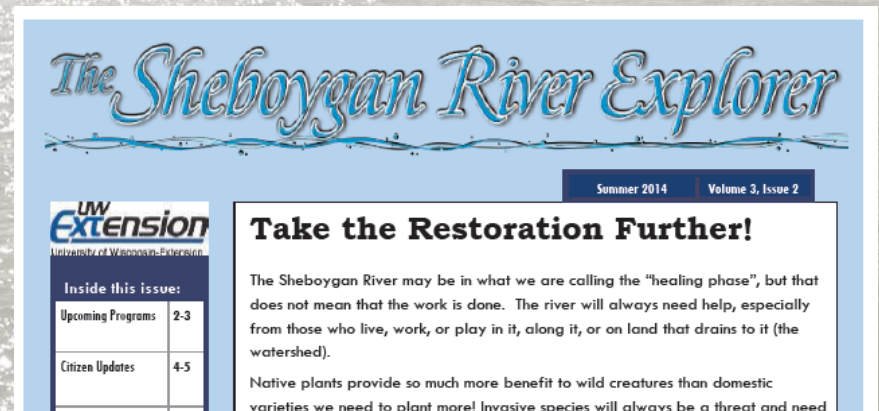
EPA funded Great Lakes Legacy Act Dredging project and Sheboygan Harbor navigational dredging (~\$55 million)

In 2011 DNR received GLRI grants for habitat restoration and fish and wildlife assessment projects (~\$6.7 million)

Final Goal of Delisting the AOC – with all work complete by September 30, 2012

Education & Outreach

- Banners on bridges
- Landing signs
- Interpretive exhibits
- Letters to businesses along river
- Weekly contractor meetings
- Contractor weekly updates
- website
- Contractors use marine radio stations
- Roving interpretation
- Periodic newsletters
- Sheboygan AOC web page
- Canoe trips
- Land-based programs and trips
- Photo/art contest and billboards
- May 19 2012 Litter Clean-up
- Frequently Asked Questions brochure
- Narrated Slide Presentations
- Dredging benefits video
- Outdoor Wisconsin TV (early 2013)
- WDNR holistic restoration video
- Testing the Waters of the Sheboygan River
- Permanent exhibits along river



Community Outreach & Education



“Big Projects”



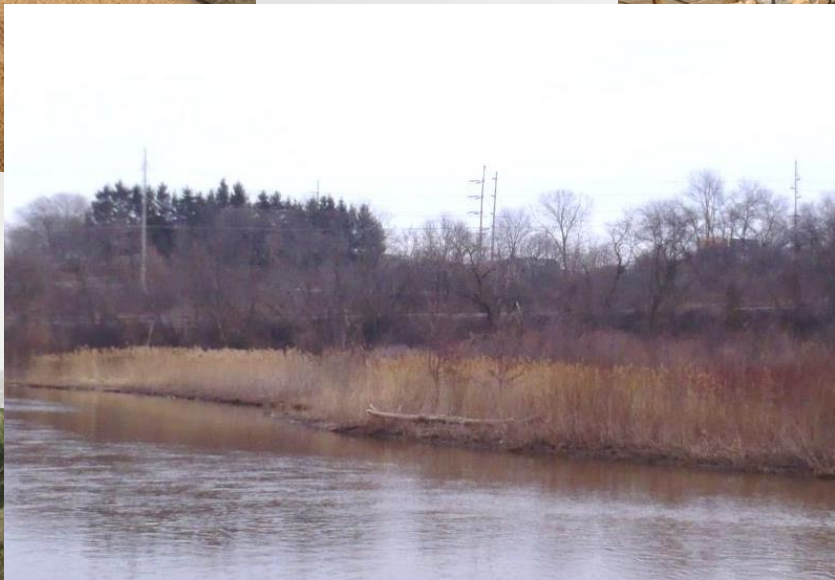
Taylor Drive & Indiana Avenue Area Wetland Restoration



Photos by Stacy Hron & Deb Beyer

Wildwood Island Area Restoration





Kiwanis Park Shoreline Restoration



Photos by Stacy Hron, WDNR



Sheboygan River Dredging Projects

Upstream of 14th Street Bridge

Some Superfund (PCB) & Legacy Dredging

Between 14th St. & Penn Ave. Bridges

Legacy Dredging & Camp Marina Superfund

Between Penn Ave. & 8th St. Bridges

Main Area of Superfund &
Legacy Projects

Downstream of 8th Street Bridge

Navigation Dredging (No
Superfund or Legacy)



Sheboygan River Area of Concern



Lower River & Inner Harbor (Legacy Act Activities)

0 0.25 0.5 Miles





Photo by Vic Pappas, WDNR



Photo by Stacy Hron, WDNR





Photo from City of Sheboygan

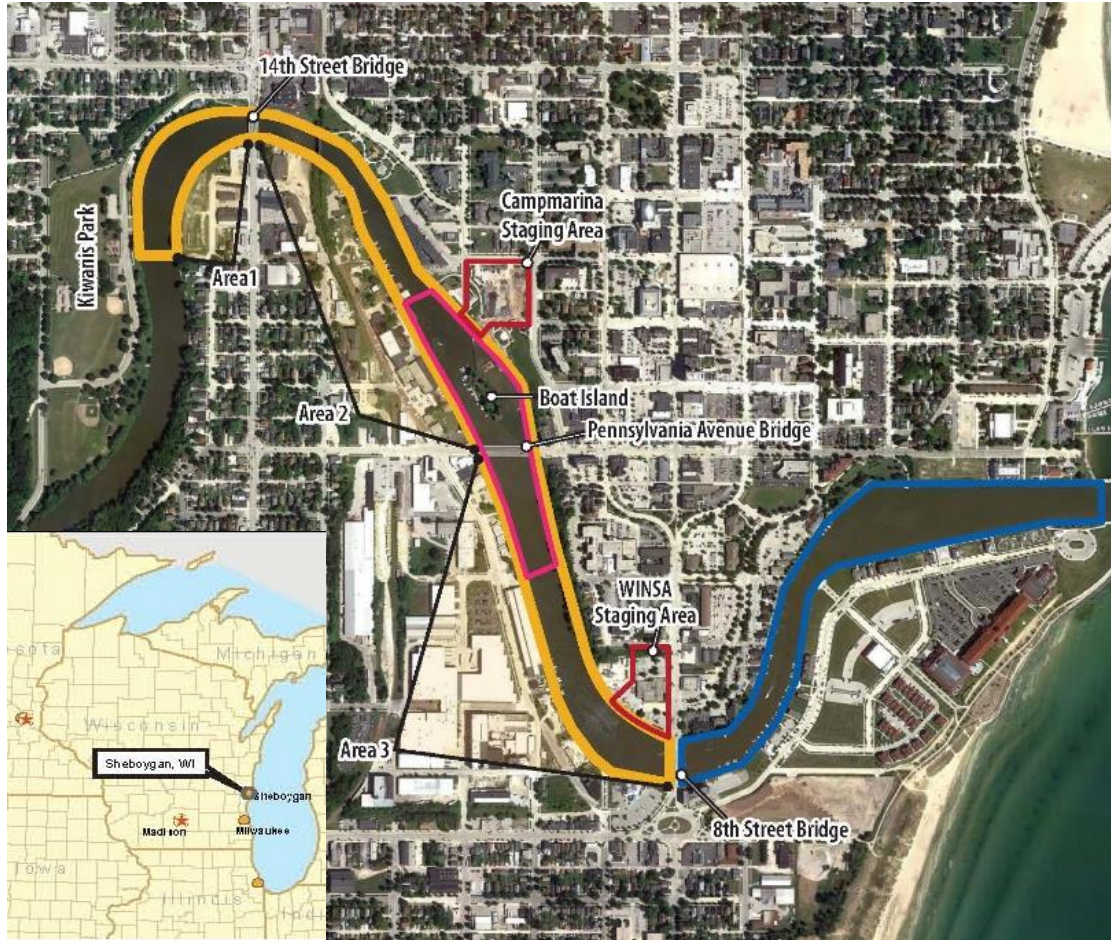
Sheboygan River Great Lakes Legacy Act Project

Overview

- Project Background
- Dredging and Construction Overview
- Unique Design and Construction Components



Project Background



Project Summary

- ~1.2 miles of river spanning 800 acres between 3 subareas
- PCB and PAH impacted sediment removal
- Two active Superfund Sites located within GLLA project area
- Separate GLLA project downstream of project (8th Street Bridge)

Timeline

- 2008 through 2010 = RI / FS
- 2010 = Remedial Design
- 2011 and 2012 = Remedial Action

Project Background

- Project Partners

- EPA GLNPO
- WDNR
- City of Sheboygan
- Responsible Parties
 - Wisconsin Public Service
 - Pollution Risk Services (PRS)

- EPA GLNPO Contractors

- CH2M
 - Remedial Design, Data Management, and Design Services during Construction
- Ryba Terra Joint Venture (RTJV)
 - Dredging and Construction



Dredging and Construction

- Remedial Action Summary

- Volume of Contaminated Sediment (cy) = 146,875
 - Non TSCA = 138,282
 - TSCA (>50 mg/kg) = 8,593
- Residual Sand Cover Placement
 - 9 acres of 6-inch sand cover



Crane operated environmental dredge bucket



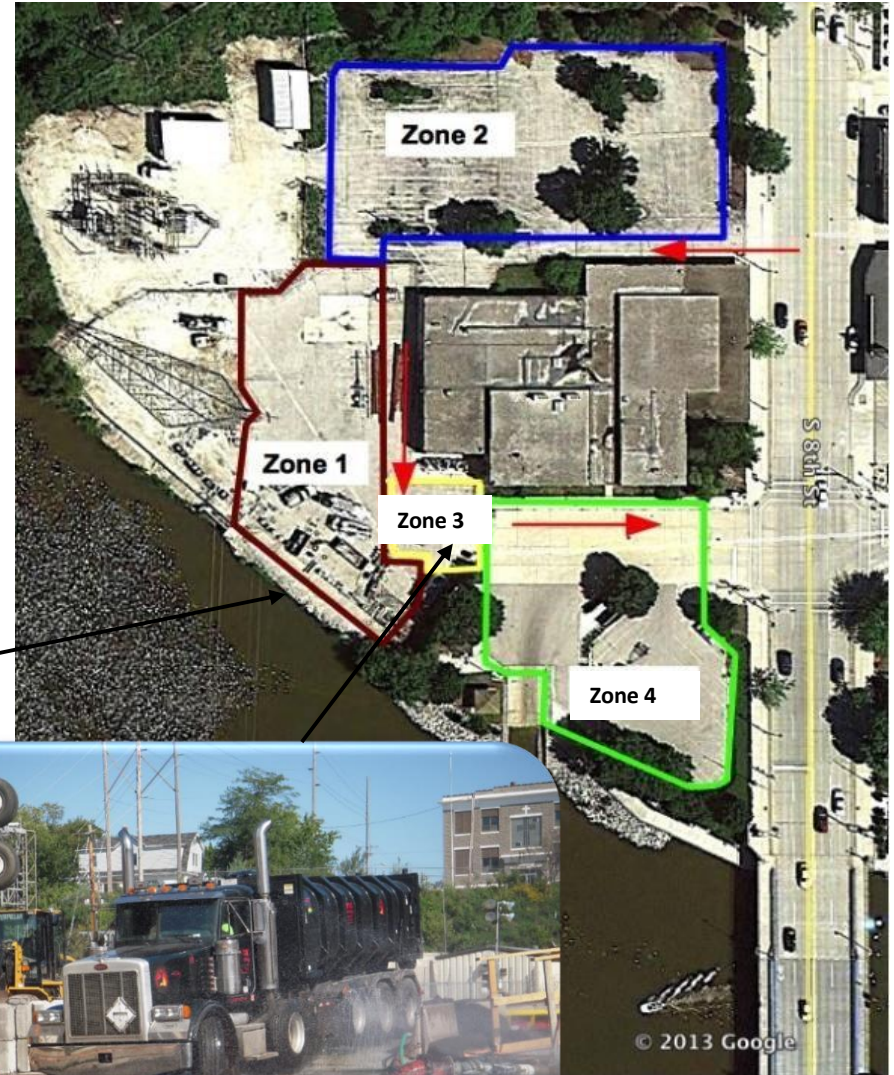
Excavator operated environmental dredge bucket



Post dredge residual management sand placement

Dredging and Construction

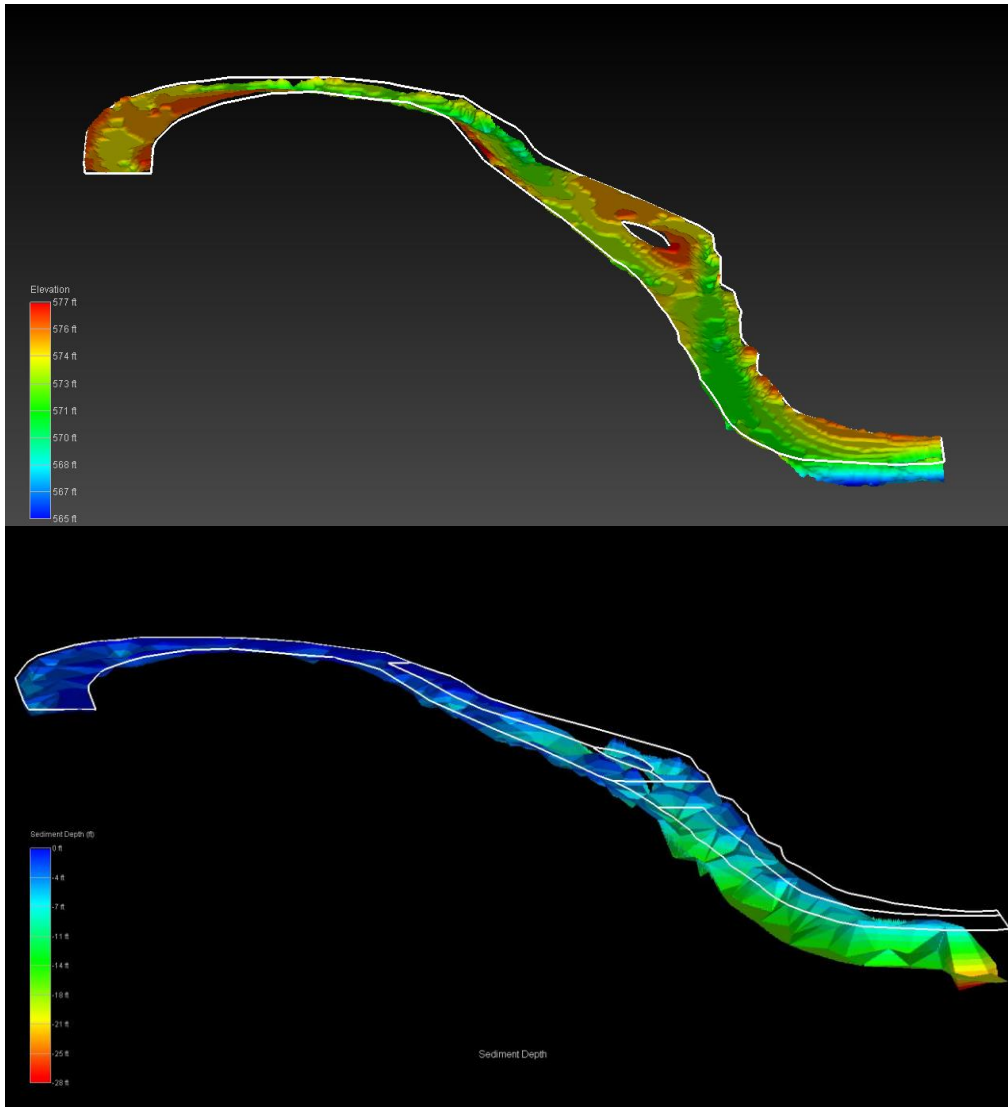
- Sediment Processing at WINSA site
 - Zone 1 = Sediment barge unloading, sediment processing, and water treatment
 - Zone 2 = Sediment stockpiling and loading area for offsite disposal
 - Zone 3 = Truck wash and decon area
 - Zone 4 = Equipment laydown and storage (clean zone)



Unique Design Component - MVS Software for Volumetric Modeling

- Mining Visualization Software (MVS)
 - Developed by C-Tech Development Corporation and originally developed for mining applications
- Tools Unique to MVS software
 - Integration of geologic and analytical data to create surfaces and solids through modeling applications
 - Material overburden quantification and visualization
 - Excavation side slope modeling
 - Integrated over-dredge volumetric calculations
 - Interactive 3d PDF's allowing users to zoom and rotate 3d model real-time
- Applications Implemented for GLLA Sheboygan River Project
 - Evaluate analytical data using three-dimensional (3D) interpolation methods to delineate horizontal and vertical extent of impacted sediment
 - Calculate volume estimates for FS and RD applications, while integrating scenarios for multiple Contaminant target concentrations as well as overburden, side slope, and over dredge allowance
 - Develop a 'surgical' dredge prism surface for integration into CAD and GIS software.
 - Provide interactive 3D visualization for stakeholder meetings

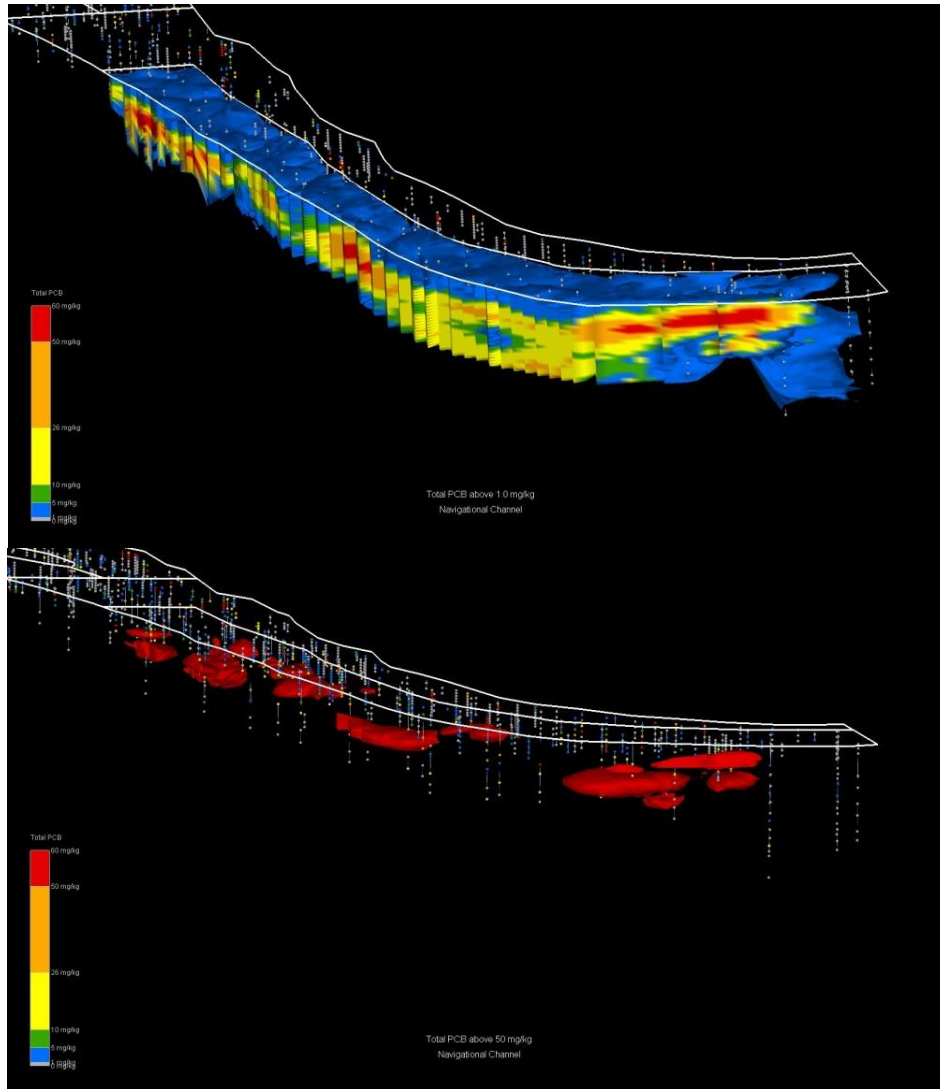
MVS Software for Volumetric Modeling



Sediment surface geologic layer represented by bathymetric data

Sediment thickness geologic layer representative of sediment core data

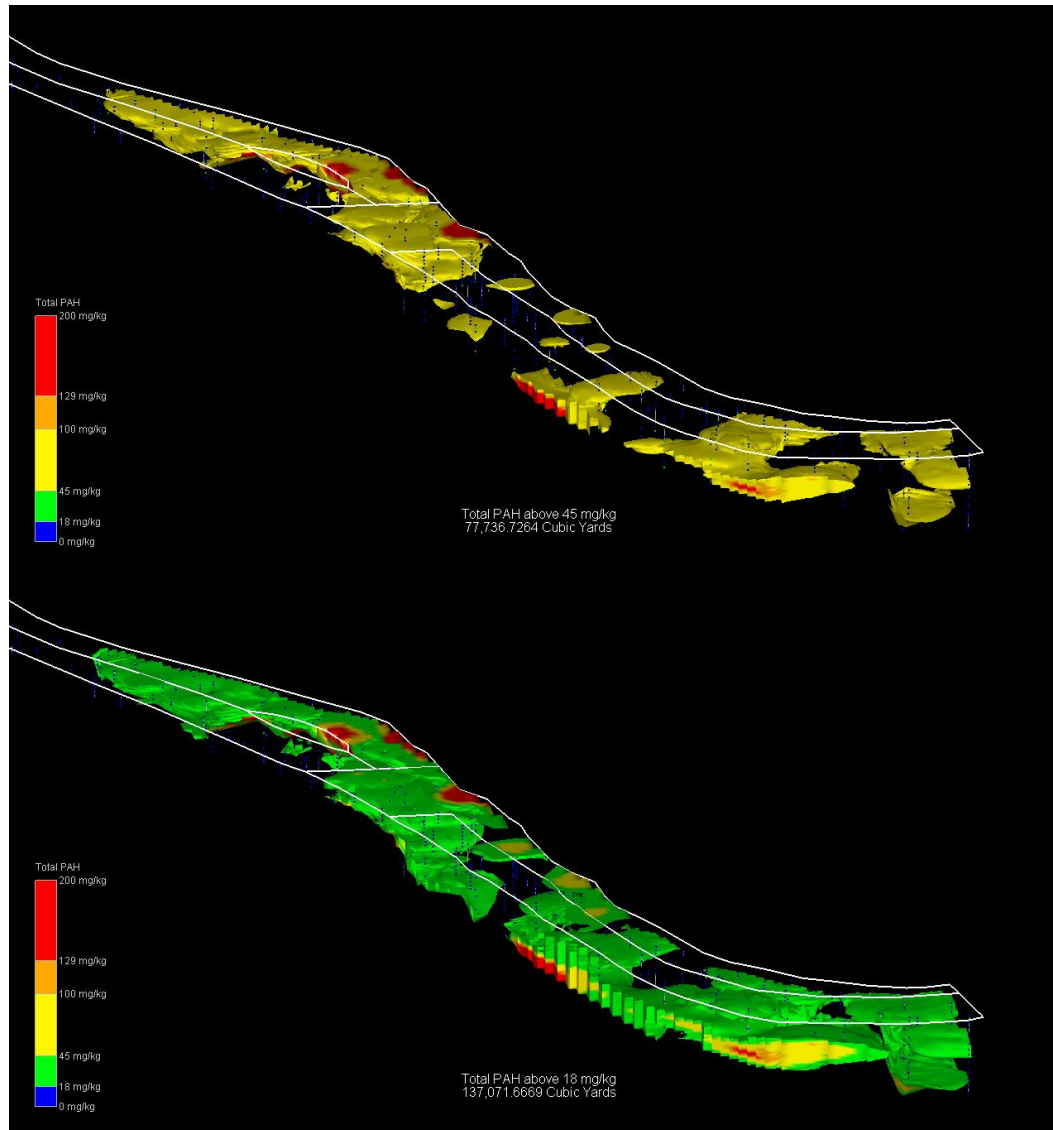
MVS Software for Volumetric Modeling



Modeled PCB plume and analytical data representing clean up goal (CUG) of >1 mg/kg.

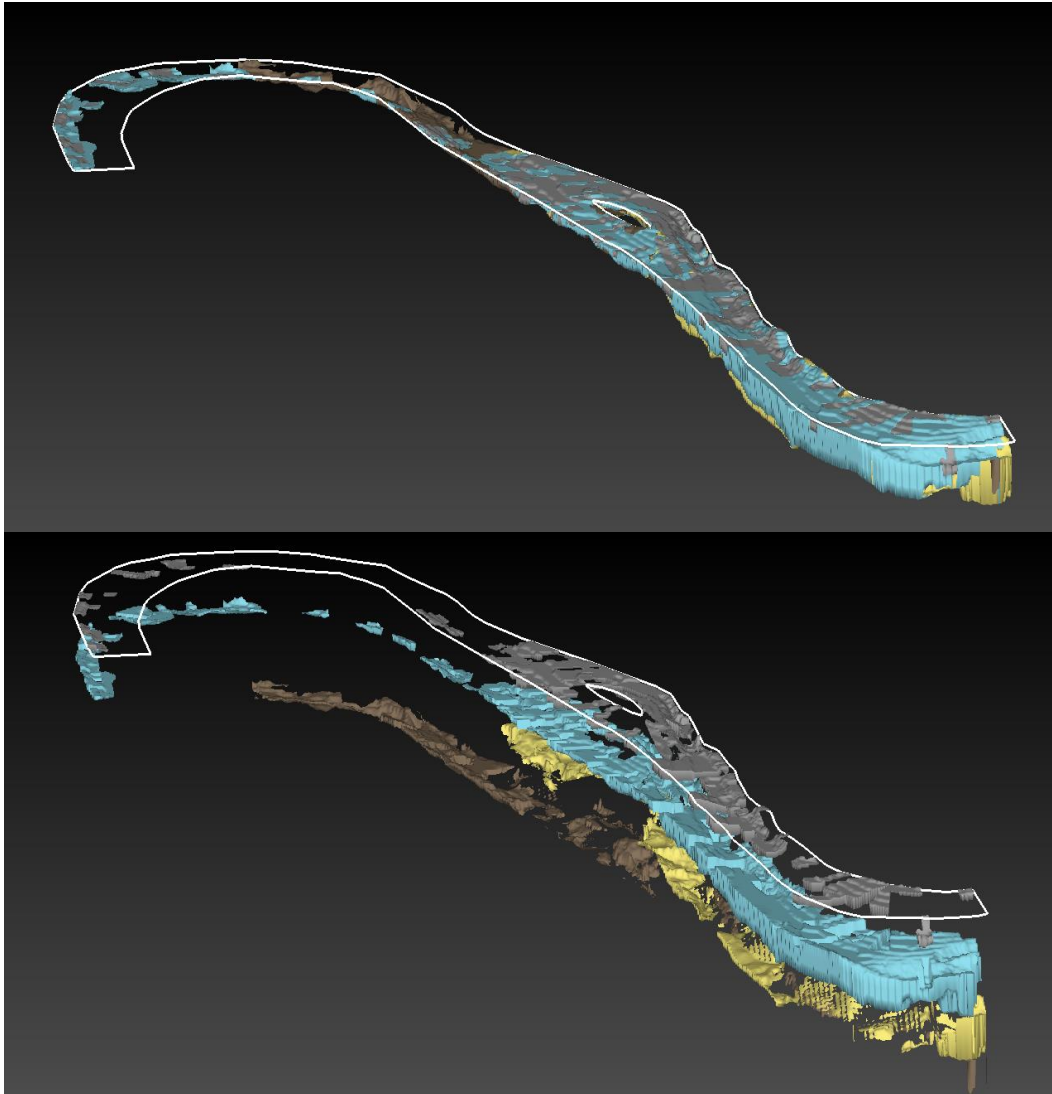
Modeled PCB plume representing TSCA sediments (>50 mg/kg).

MVS Software for Volumetric Modeling



- Comparison of clean up goal concentrations
 - MVS allows for visual comparison of multiple CUG concentration scenarios and respective volumes
 - Total PAH comparison between 45 mg/kg (top) and 18 mg/kg (bottom)

MVS Software for Volumetric Modeling



- Geologic Layer Visualization
 - Used to quantify and visualize various categories of sediment removal – not just typical “geology”
 - Grey = Superfund project dredge removal overlapping Sheboygan River Project.
 - Blue = PCB removal > 1 mg/kg
 - Yellow = Additional sediment removal to achieve PAH removal > 45 mg/kg
 - Brown = Sediment removal required for access channel for barge draft requirements to reach upstream Area 1.

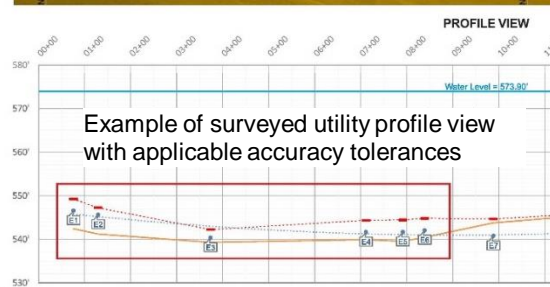
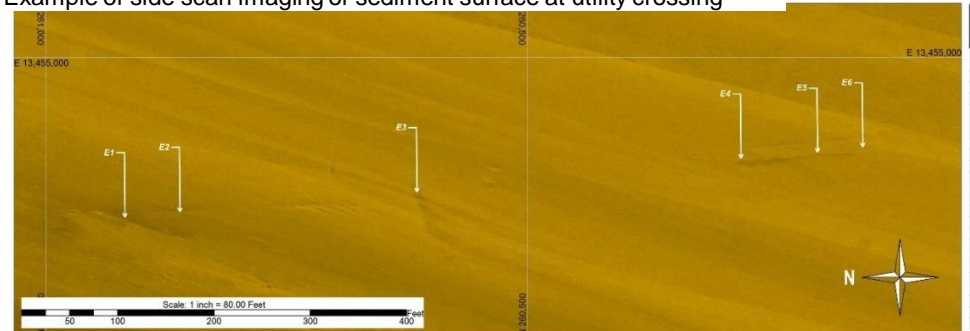
Unique Design Component – Active Utility Survey

- SPAR Survey Technology
 - Electromagnetic survey technology allows for 3D surveying of active or abandoned utilities
 - Typical utility locate services and utility owner could not verify depth of a 13.8 kV electric cable crossing
- Advantages
 - Implementation of SPAR technology was able to determine the lateral and vertical position of the utility within +/- 12 inches
 - Verification of vertical position allowed for safe removal of overlying impacted sediment and meeting remedial action objectives
 - Typical alternative is to apply an offset from lateral position of utility location where no dredging or anchoring can take place.



SPAR survey technology outfitted on shallow draft vessel.

Example of side scan imaging of sediment surface at utility crossing



Example of 3D depiction of surveyed utility.

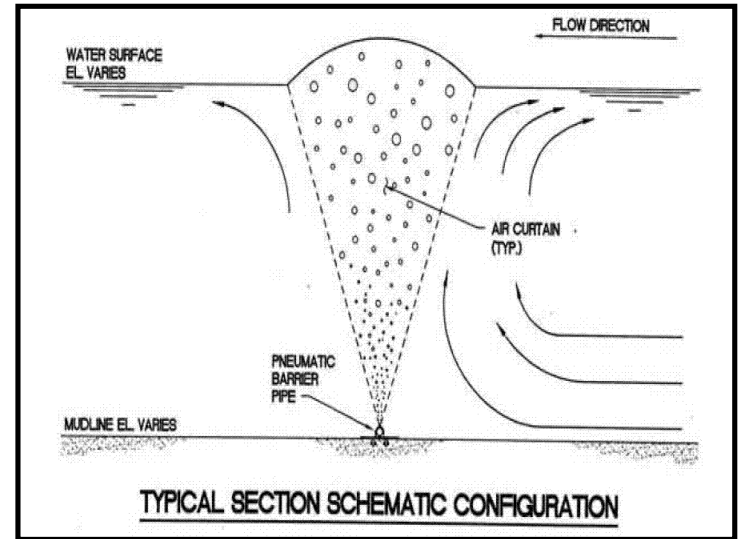
Unique Construction Component – Excavator Mounted Environmental Bucket

- Excavator Mounted Environmental Bucket
 - Implements environmental bucket dredge and GPS technology with the maneuverability of an excavator.
 - Environmental buckets allow for level dredge cuts for improved dredge accuracy
 - Implements water vents with baffles and overlapping side plates to reduce material loss, sediment resuspension, and turbidity
- Advantages
 - Outfitted onto smaller barges allowed for accessing upstream shallow draft areas and navigate under bridges
 - Down pressure could be applied for greater penetration into consolidated sediments critical for deeper PAH impacted sediments and removal of debris
 - Allowed for quick repositioning and tilting of bucket for accurate and efficient dredging of side slopes
 - Incorporation of environmental bucket features reduced sediment resuspension and turbidity



Unique Construction Component – Silt Bubble Turbidity Curtain

- What is a “Silt Bubble Curtain”
 - Perforated pipe extending across river channel
 - Typically trenched in a few feet into the existing sediment
 - Compressed air is continuously blown through the pipe creating a wall of bubbles which rises to the water surface.
 - Wall of bubbles causes some suspended solids in the water column to fall out.
- Advantages
 - Allows unimpeded vessel travel while providing a barrier to suspended sediments from dredging
 - Allows free passage of migratory fish
 - Maintains effectiveness in varying water levels (seasonal, seiche effect, etc.)
 - Installation and operation costs are typically offset by maintenance and replacement of typical turbidity curtains
 - More environmentally friendly by avoiding the need to decontaminate and/or landfill conventional turbidity curtains



Silt bubble curtain installed at downstream extent of project (8th Street Bridge).

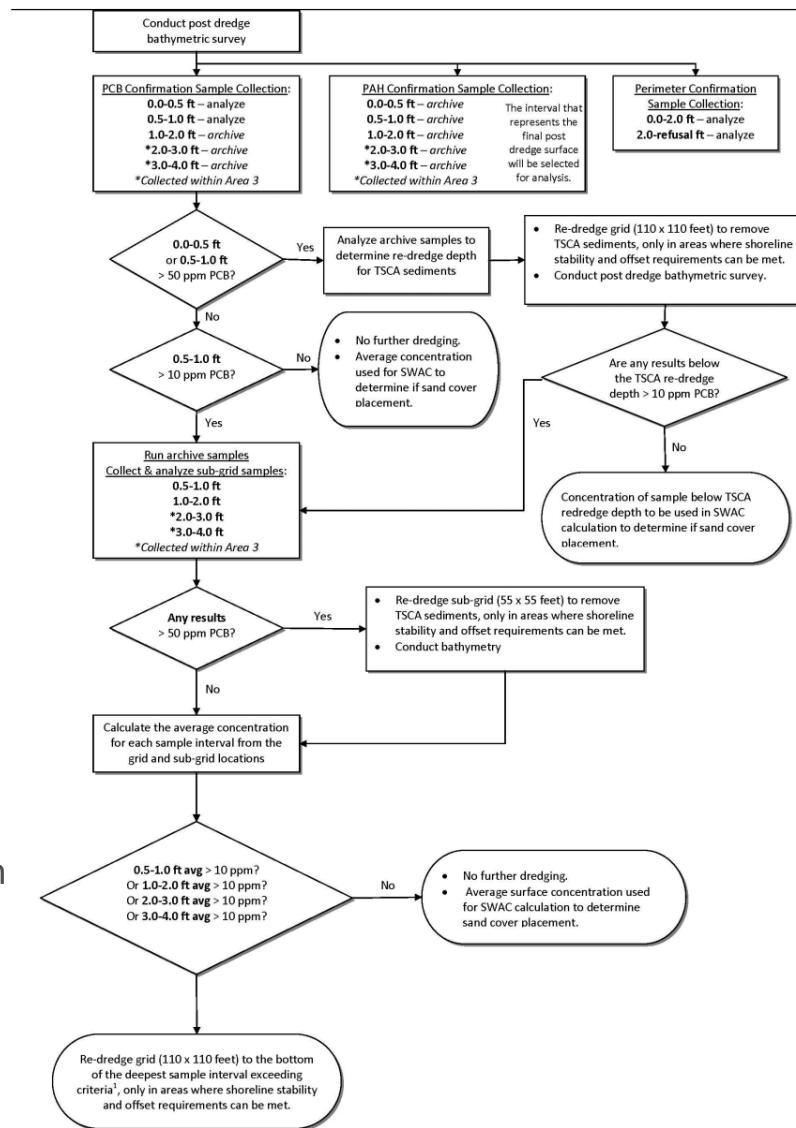
Unique Construction Component - Rapid Confirmation Sampling & Re-dredge Design

- Goals and Objectives of Confirmation Sampling
 - Rapidly perform and implement sediment confirmation sampling for re-dredge decision making (if necessary).
 - Develop re-dredge design files accurately and timely to avoid dredge schedule delays and stand-by time charges
 - Provide sufficient data to document post dredge PCB and PAH sediment concentrations and perform SWAC calculations
 - Complete process with clear communication amongst project stakeholders and accurate documentation of re-dredge decision making

Rapid Confirmation Sampling

- Sequence of Post Dredge Confirmation Sampling
 - Post dredge Bathymetry Survey
 - Verified against design specification requirements
 - Sediment Confirmation Sampling
 - PCB and PAH results verified against respective clean up goal concentrations
 - Re-dredge Design and Implementation
 - Performed in accordance with dredge specifications
 - Rolling SWAC Calculation
 - Surface weighted average concentration of project area calculated to determine residual sand cover placement.

Post-Dredge Confirmation Sampling Flow Chart



Rapid Confirmation Sampling

- Sampling Technology Selection and Data Quality
 - Sampling technologies implemented need to meet data objectives



Vibracore sampler



Slide hammer coring



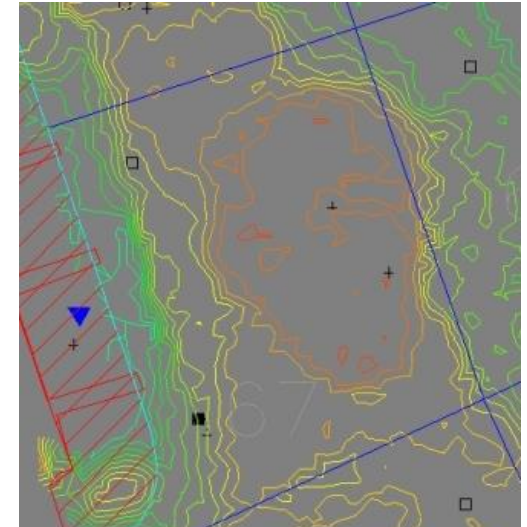
Manual soil auger

Re-dredge Design and Implementation

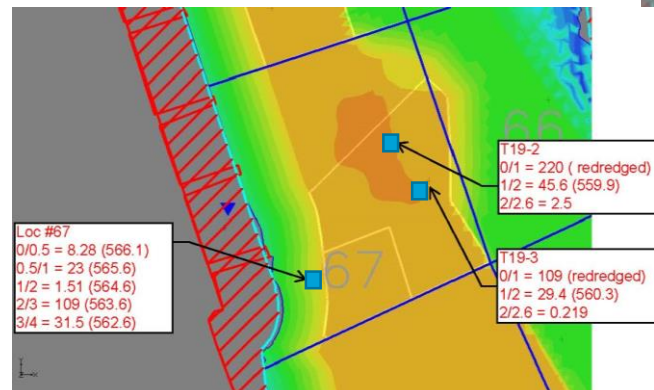
- Collaborative effort between CH2M and project partners
 - EPA GLNPO, WDNR, RTJV, and Superfund Project representatives
- Re-dredge Lateral and Vertical Extent Determination
 - Confirmation Sampling Results
 - Post Dredge Bathymetry
 - Design Specifications
- Re-Dredge Volume Summary
 - 9,300 cy (~6% of dredge total)
 - PCB re-dredge = 4,300 cy
 - PAH re-dredge = 5,000 cy
 - Analytical model accuracy = 94%



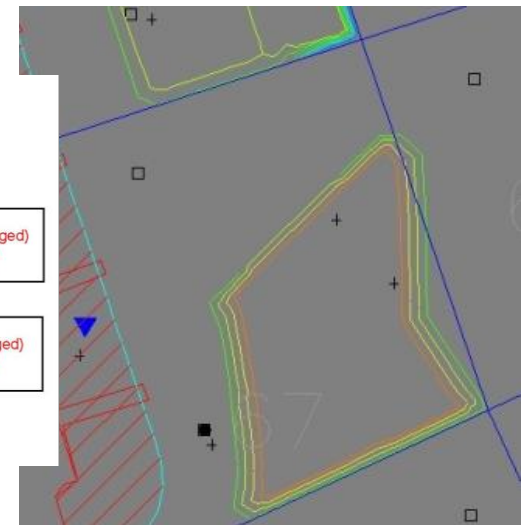
1) Initial Remedial Design dredge contours



2) Post-Dredge Conditions following dredging



3) Post-dredge confirmation sampling results



4) Re-dredge design following data interpretation

Next Steps - Verification

Pre Project or Concurrent Assessment

- Waterfowl Tissue (Advisory)
- Fish Tissue (Advisory)
- Fish Tumors
- Plankton & Benthos
- Tree Swallows
- Fish Community
- Macroinvertebrates
- Aquatic Habitat
- Herptiles
- Breeding Birds
- Bats
- Mussels
- Wintering Birds
- Fish-Eating Birds
- Small Mammals and Mink
- Natural Community/Rare Plant/Invasive Plant



Post

- Waterfowl Tissue (Advisory)
- Fish Tissue (Advisory)
- Fish Tumors
- Plankton & Benthos
- Tree Swallows
- Fish Community
- Macroinvertebrates
- Aquatic & Terrestrial Habitat
- Herptiles
- Breeding Birds
- Bats
- Mussels
- Mink
- Natural Community/Rare Plant/Invasive Plant
- Sediment Toxicity & Aquatic Toxicity



Photo by Deb Beyer