Recovering Sheboygan Harbor
A Unique Teaming Effort to Restore Navigation Depth and Remove Contaminated Sediments

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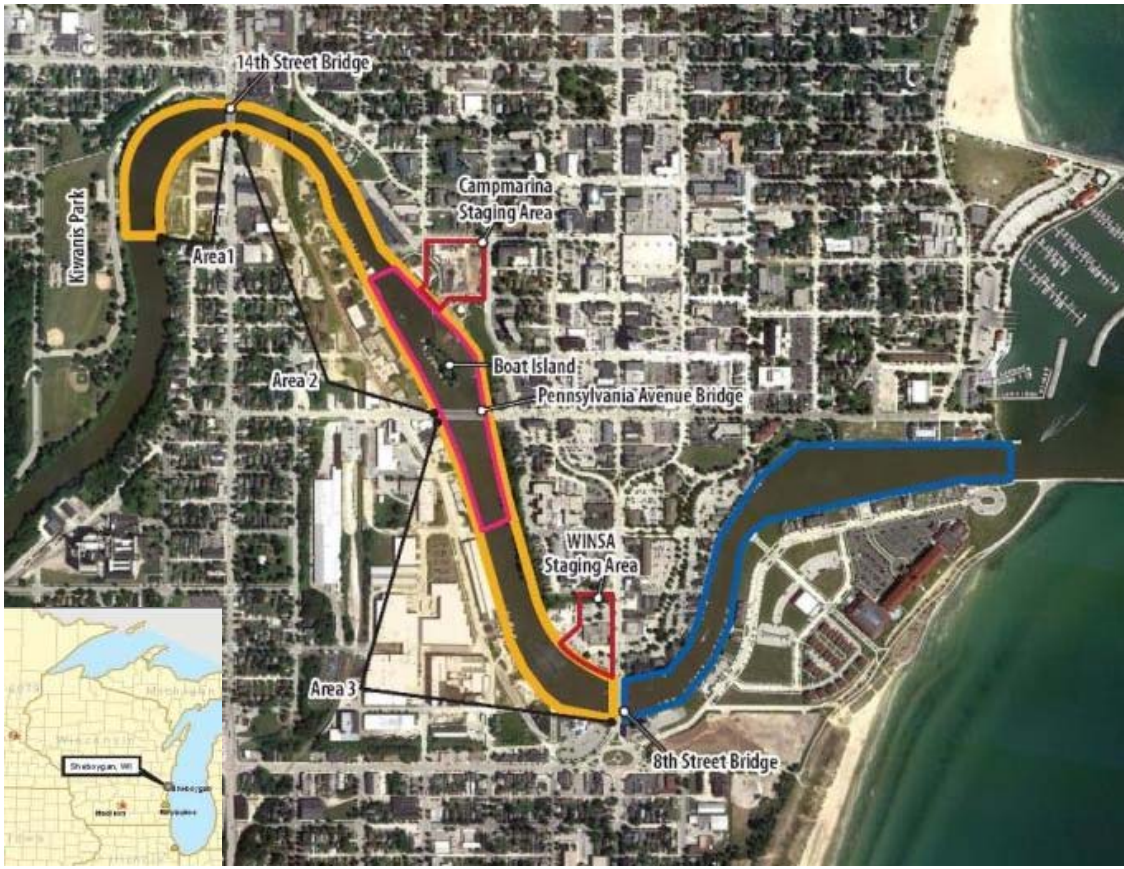
SAME DCHWS Design and Construction Issues at Hazardous Waste Sites
March 29, 31 and April 1, 2021

Presentation 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 Great Lakes Legacy Act (GLLA) project area
  - Separate Great Lakes Restoration Initative (GLRI) project downstream of project (8th Street Bridge)
- Timeline
  - 2008 through 2010 = RI / FS
  - 2010 = Remedial Design
  - 2011 and 2012 = Remedial Action



Parties Involved

- Project Partners
  - EPA GLNPO
  - WDNR
  - City of Sheboygan
  - Responsible Parties
    - Wisconsin Public Service
    - Pollution Risk Services (PRS)
- EPA GLNPO Contractors
  - CH2M (Jacobs)
    - Remedial Design, Data Management, and Design Services during Construction
  - Ryba Terra Joint Venture (RTJV)
    - Dredging and Construction
- USACE Strategic Dredging Project Contractors
  - Sevenson Environmental

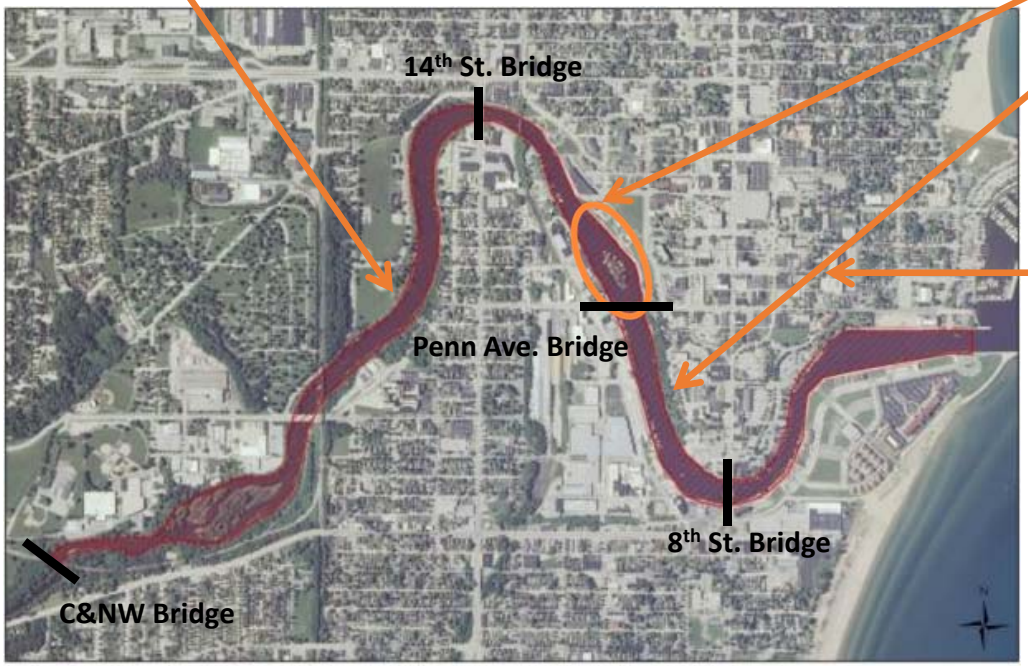
Sheboygan River Dredging Projects

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
Navigational Dredging (No Superfund or Legacy)



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

Photo from City of Sheboygan

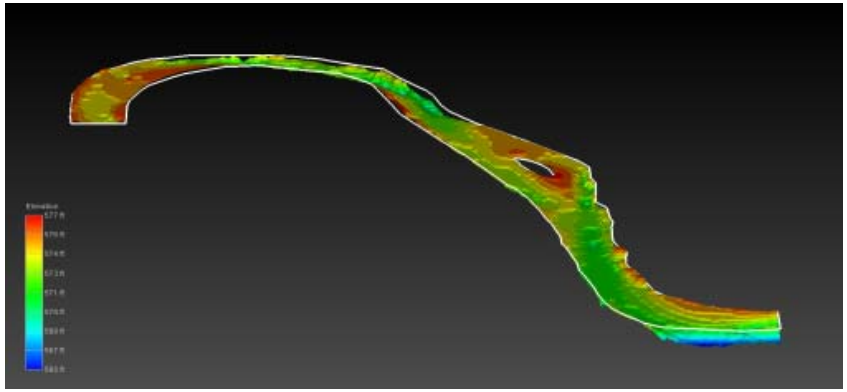
Photo by Vic Pappas, WDNR

Photo by Stacy Hron, WDNR

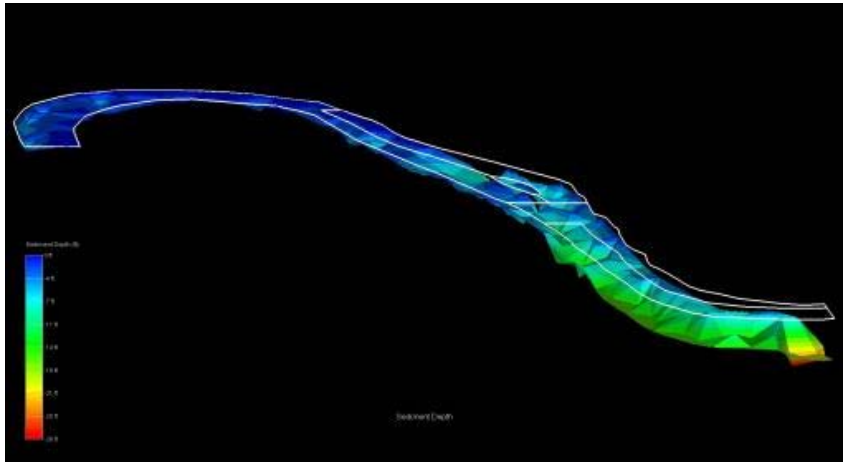
Unique Design Component - MVS Software for Volumetric Modeling

- 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

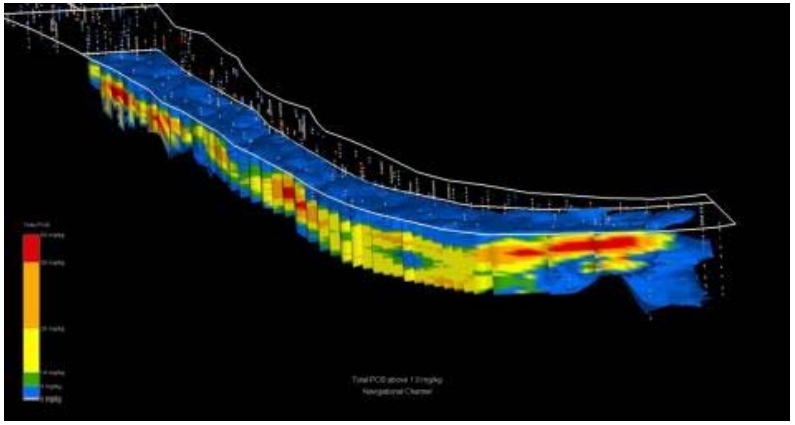


Sediment surface geologic layer represented by bathymetric data

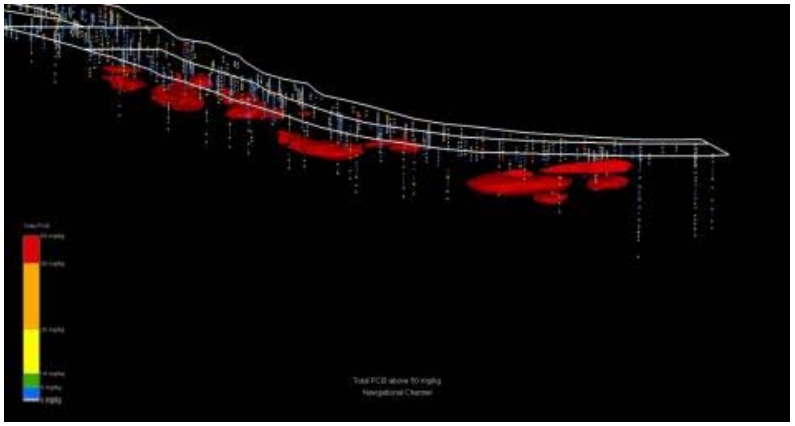


Sediment thickness geologic layer representative of sediment core data

MVS Software for Volumetric Modeling

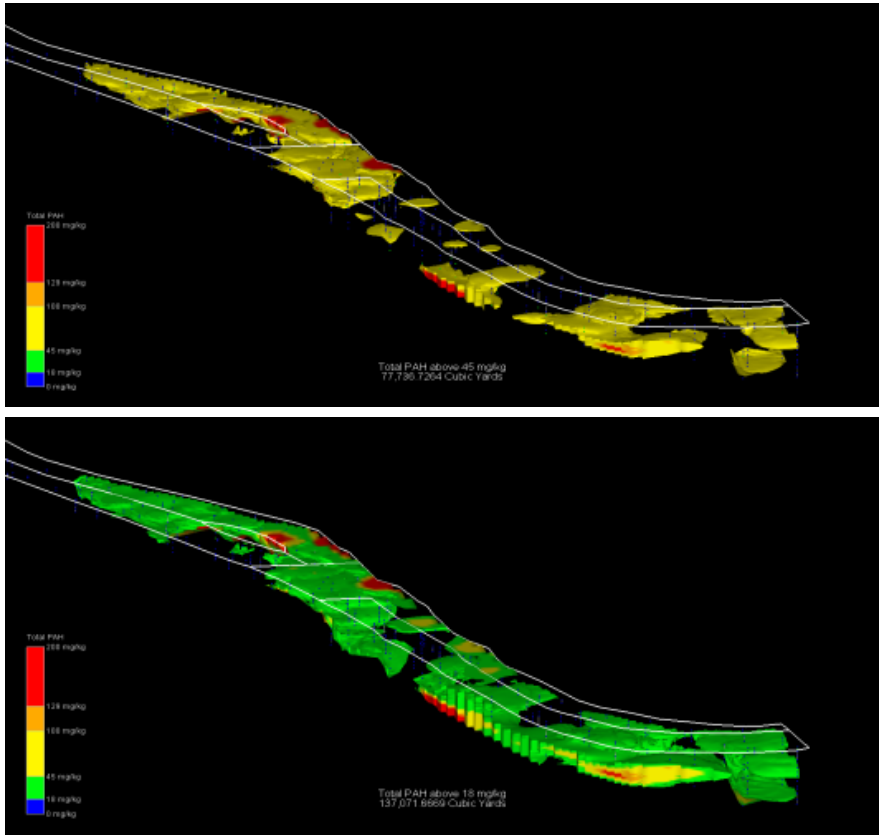


Modeled PCB plume and analytical data representing clean up goal (CUG) of >1 mg/kg.



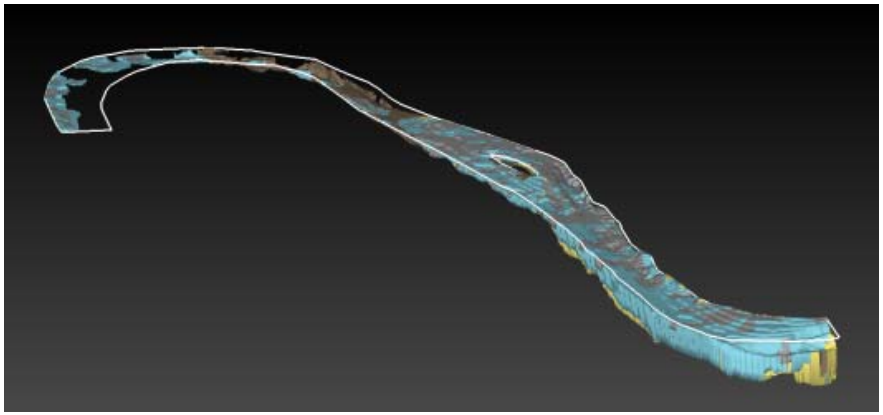
Modeled PCB plume representing TSCA sediments (>50 mg/kg).

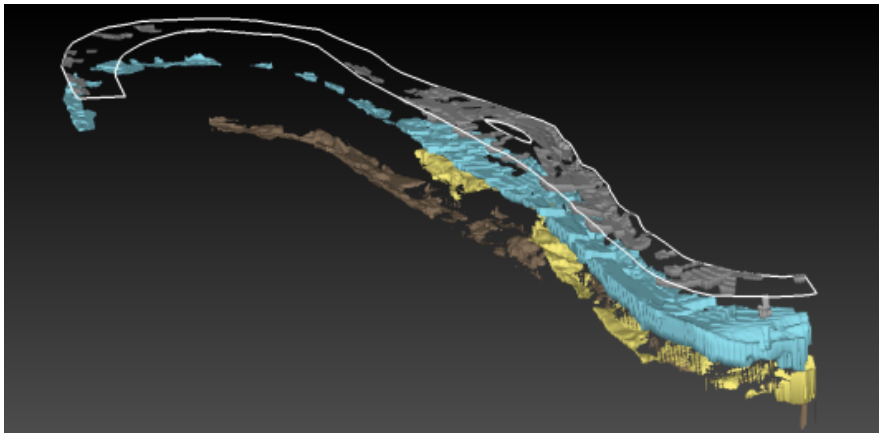
MVS Software for Volumetric Modeling



- 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





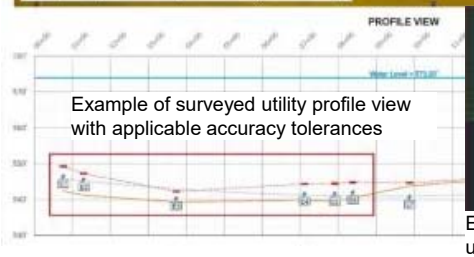
- Geologic Layer Visualization
  - Used to quantify and visualize various categories of sediment removal – not just typical “geology”
    - Grey = Superfund project dredge removal overlapping Sheboygan River Project.
    - Blue = PCB removal > 1 mg/kg
    - Yellow = Additional sediment removal to achieve 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

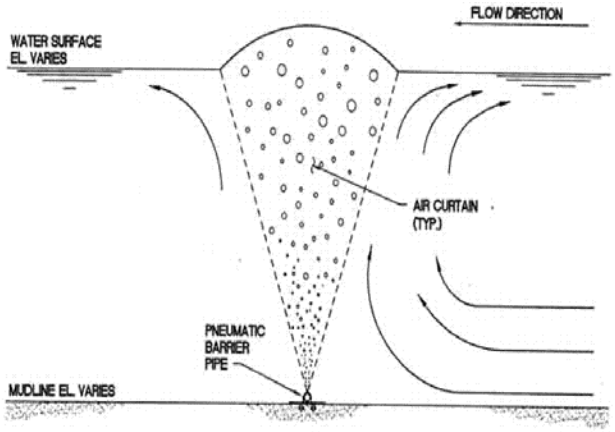


Example of surveyed utility profile view with applicable accuracy tolerances

Example of 3D depiction of surveyed utility.

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



TYPICAL SECTION SCHEMATIC CONFIGURATION

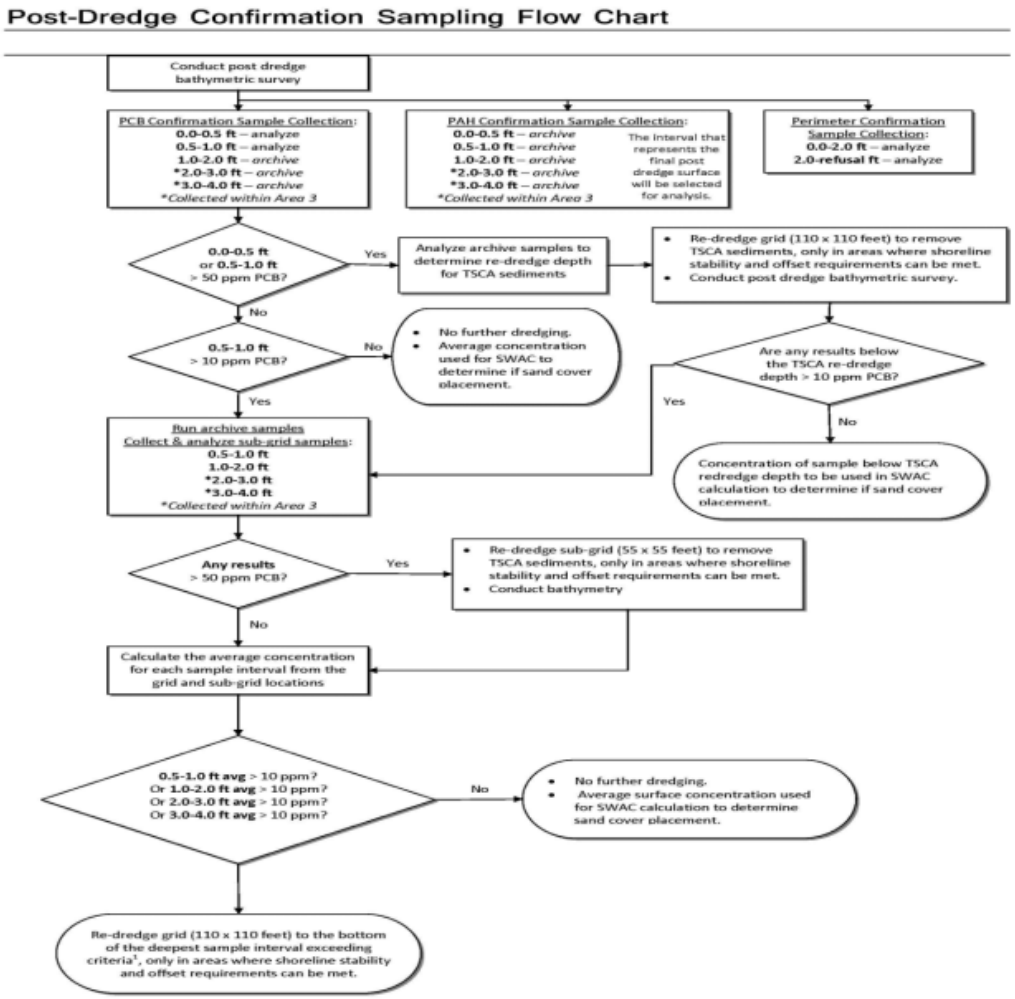
Silt bubble curtain installed at downstream extent of project (8th Street Bridge).

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

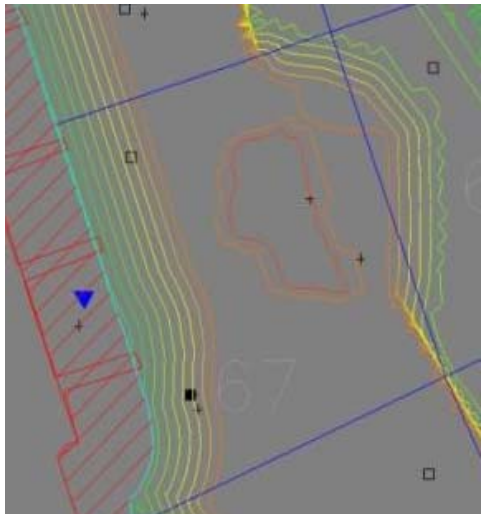
Rapid Confirmation Sampling

- 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.

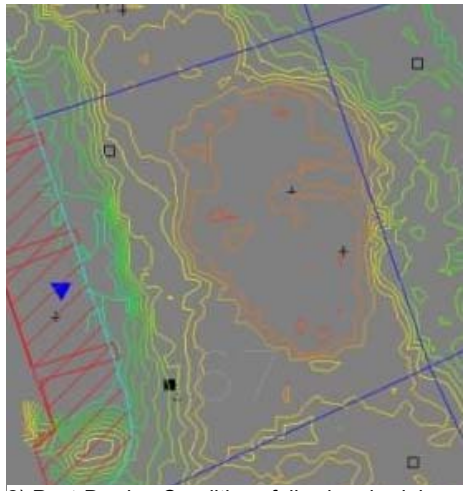


Re-dredge Design and Implementation

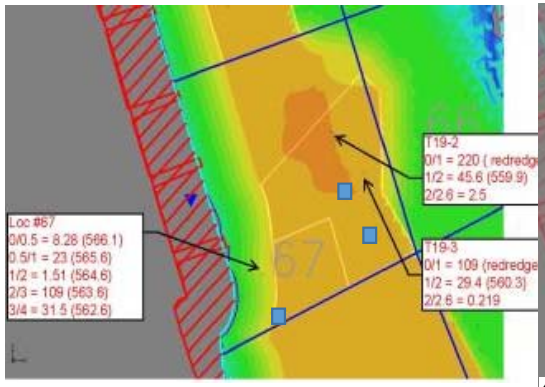
- Collaborative effort between CH2M and project partners
  - EPA GLNPO, WDNR, RTJV, and Superfund Project representatives
- Re-dredge Lateral and Vertical Extent Determination
  - Confirmation Sampling Results
  - Post Dredge Bathymetry
  - Design Specifications
- Re-Dredge Volume Summary
  - 9,300 cy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



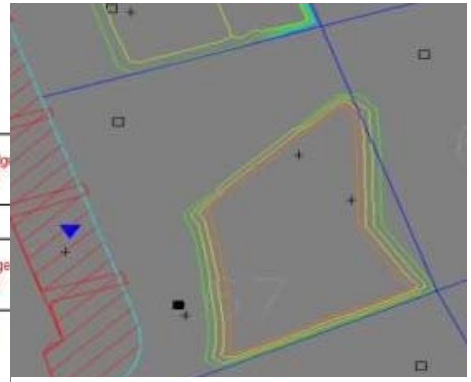
1) Initial Remedial Design dredge contours



2) Post-Dredge Conditions following dredging



3) Post-dredge confirmation sampling results



4) Re-dredge design following data interpretation

Questions?

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Great Lakes RESTORATION

SAME

Photo by Deb Beyer

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