Combination Remedy Innovations & Issues Fox River

Passaic River Community Advisory Group
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James Hahnenberg
U.S. EPA RPM
Today's topics
Fox River cleanup

• Combination remedy & modification of original decisions

• Cleanup innovations & lessons learned

• Community issues
Fox River PCB cleanup

• Largest environmental sediment cleanup

• $800 million cleanup cost estimate

• Collaborative effort between Agencies (State lead) and companies
## Fox team

<table>
<thead>
<tr>
<th></th>
<th>Upper river</th>
<th>Lower river</th>
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</thead>
<tbody>
<tr>
<td>Agencies</td>
<td>WDNR* &amp; EPA</td>
<td>Boldt, NRT, et al</td>
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<tr>
<td>Agencies oversight</td>
<td></td>
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<tr>
<td>Potentially Responsible Parties (PRPs)</td>
<td>• Glatfelter</td>
<td>• API</td>
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<tr>
<td></td>
<td>• WTMI</td>
<td>• NCR</td>
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<td></td>
<td>• Menasha</td>
<td>• GP</td>
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<td>PRP contractors</td>
<td>• Brennan</td>
<td>• Tetratech</td>
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<td>• CH2MHLI</td>
<td>• Brennan</td>
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<td>• Boskalis-Dolman</td>
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* Lead Agency
Agency oversight team

Photo courtesy of Boldt
Fox cleanup decisions

2002/2003

Dredging/disposal (with capping contingency)

2007/2008

Dredging/disposal
Engineered caps
Thin cap
Cap monitoring & maintenance

PCB Action Level: 1 ppm
PCB post-cleanup goal: 0.25 ppm
Changes to initial decisions

• 50% dredging & 50% capping from all dredging

• **Caps** - 3.4 million cubic yards vs. 0.5 million cubic yards* previously

• **Thin caps** - 0.6 million cubic yards*

* Volumes based on Decision documents and final results (where completed).
Capping & covering details

• Dredge and cap (for deep PCBs)
  – Navigation channel (PCBs up to 15’ below mudline)
  – Along river banks

• Caps generally over areas with lower PCB concentrations

• “Covers” or thin caps
  – Placement of 6 inches of sand
  – Over areas with 6-inches or less with PCB concentrations 1-2 ppm
Things that didn’t change

• **PCB Action Level** (for targeted areas): 1 ppm

• **PCB post-cleanup goal**: 0.25 ppm average surface concentrations

• Landfill disposal for dredged (although less volume)

• Time after cleanup needed to get to acceptable fish levels
New information (2006)

- 1,300 cores*
- 9,100 samples* (6-inch intervals)
- Design

Note: as of 2010: 3000 cores & 16,000 samples
New information

1. More PCB sediments & new hotspot
2. Deep contamination (15’+)
3. Thin zones with 1-2 ppm PCB concentrations
4. Landfill capacity compared to dredge volume
5. River bank stability
Dredging/capping/covering vs. All-dredging remedy

• 9 years versus 15+ years for cleanup work

• Lower surface PCB concentrations after cleanup

• 74% of PCBs still removed compared to all-dredging approach
Dredging/capping/covering vs. All-dredging remedy

- Less disposal volume
- Flexibility
- Costs
  - Dredging/capping/covering: $700 million
  - All-dredging: $957 million
Cap stability considerations

• Capping & dredging experience

• Possible disruptive effects
  – Propeller wash
  – High flow events
  – Ice scour
  – Biological effects
Possible cap maintenance actions

1. Additional monitoring and evaluation
2. Cap repair
3. Cap & sediment removal
Cap summary

- Caps stable
- Larger armor stone gives safety margin
- Tailored for different situations
- Monitoring and maintenance
- Re-evaluation triggered if water level changes (determined by Agencies)
Environmental hydraulic dredge

Environmental mechanical dredge

Photos courtesy of Boldt
Mechanical vs. Hydraulic dredging

• Mechanical dredging better for:
  – Areas with debris
  – Tighter spaces (e.g., near infrastructure)

• Hydraulic dredging better for:
  – Thinner sediment “cuts”
  – Lower resuspension (?)

• Other operational aspects need consideration (e.g., access, dewatering methods, transportation, and disposal)
Upper river
2004 – 2009
800,000 cy
$100 million

Lower river
2009* – 2017
7.2 million cy
$700 million

* Phase 1 completed in 2007
Fox cleanup timeline

- **Lower river capping/covering**: 2009 to 2017
- **Lower river dredging**: 2005 to 2010
- **Upper river**: 2005 to 2009

Year:
- 2005
- 2010
- 2015
- 2020
Dredging & related innovations

- GPS – RTK system for dredging
- Neatline dredging
- Vic Vac® dredge
- Multiple hydraulic dredges
- Geotextile tubes for dewatering (upper river)
Other project innovations

- Cap placement method
- Infill sampling of dredge areas
- Annual Work Plans
Fox upper river
Cleanup actions
(northern half)

Legend

- Capped
- Dredged areas
- Sand covered
- No Action

Figure 1-3, from: GW Partners, LLC, Remedial Action Certification of Completion Report, Lower Fox OU1, November 2010.
Dredging process
upper river

1. Dredge
2. Thickeners
3. Geotextile tube dewatering
4. Water Treatment Plant
5. Truck

12% solids
15% solids
35% solids

Dredging process
upper river
“Small” cutterhead dredge

Photo courtesy of Boldt
Dredge operator controls: GPS – RTK

Photo courtesy of Boldt
Monitor for dredge operator

Dredge arm

Dredge

“Neat” line (1 ppm PCB target elevation)

“Overdredge” line

Dredge head

Photo courtesy of Boldt
Vic Vac®
dredge

Post-dredge PCB concentrations: less than 0.19 ppm from greater than 50 ppm
In-river pipeline

from dredge
to dewatering &
water treatment
Dredging

2004 – 2008 dredging upper river

Dewatering (geotextile tubes)

Loading

Disposal

Photos courtesy of Boldt
Stacked geotextile tubes

37% solids after water drains out

From: GW Partners, LLC, Remedial Action Certification of Completion Report, Lower Fox OU1, November 2010.
# Geotextile tubes for dewatering

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
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<tbody>
<tr>
<td>No moving parts &amp; less manpower</td>
<td>More space needed</td>
</tr>
<tr>
<td>Lower dewatering cost</td>
<td>Lower solids content (may increase disposal costs)</td>
</tr>
<tr>
<td>Flexibility (tubes always available)</td>
<td>Tube breakage</td>
</tr>
</tbody>
</table>
“Throwing stone”
(cap armor stone)

Photo courtesy of Boldt
Cap designs

- Armor stone thickness: 7” – 24”
- Sand thickness: 6” – 9”
- Contaminated sediment
- Stone size: 0.75” - 9”
- Coarse sand
Thin cap ("sand cover")

6-inches of sand

Mixing zone

Contaminated sediment
Lower river cleanup

2009–2017
7.2 million cy
$700 million
Lower river cleanup

Dredging

Dredge and Cap

Cap (sand and gravel)

Cover (sand only)

Courtesy of Tetra Tech
Lower river cleanup

Dewatering & water treatment facility

Dredging

Cap (sand and gravel)

Dredge and cap

Cover (sand only)

Courtesy of Tetra Tech
Infill sampling
lower river

7 samples/acre
to
28 samples/acre
for dredge areas
Multiple hydraulic dredges (lower river)

<table>
<thead>
<tr>
<th>Output pipe</th>
<th>Auger</th>
<th>Contamination thickness</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 inches</td>
<td>24 inches</td>
<td>2 - 3 feet</td>
<td>2</td>
</tr>
<tr>
<td>12 inches</td>
<td>36 inches</td>
<td>3 - 12 feet</td>
<td>1</td>
</tr>
</tbody>
</table>

Dredging operations
• April – November
• 24 hours/day, 5 days/week
Debris removal

- Magnetometer and side scan sonar identify debris areas
- Backhoe used
- Mostly old wood pilings (some steel and rock also)
- 19 areas (23 acres) with debris of 1200 total acres being cleaned up
Debris removal

Photos courtesy of Boldt
Debris

Photo courtesy of Boldt
Dewatering facility for lower river cleanup

Photo courtesy of TetraTech
Plate and frame presses

55% solids after dewatering

Photo courtesy of Boldt
Landfill disposal

Photo courtesy of Boldt
“Beneficial re-use” of sand

2010: 35,000 tons of sand of 300,000 tons sediment - roadway construction (PCB concentration: ~0.27 ppm)

<table>
<thead>
<tr>
<th>Possible opportunity</th>
<th>Description of use</th>
<th>Estimated PCB concentrations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bayport disposal facility</td>
<td>Construction</td>
<td>≤ 1 ppm</td>
</tr>
<tr>
<td>Landfill</td>
<td>Construction</td>
<td>≤ 5 ppm</td>
</tr>
<tr>
<td>Roadways</td>
<td>Construction</td>
<td>≤ 1 ppm</td>
</tr>
<tr>
<td>Mines</td>
<td>Reclamation</td>
<td>≤ 0.25 ppm</td>
</tr>
<tr>
<td>Upland</td>
<td>Construction for non-residential uses</td>
<td>≤ 1 ppm</td>
</tr>
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Photo courtesy of Boldt
Community issues

• Cap “permanence” (discussed earlier)

• Transportation & disposal of dredged sediment

• Sediment disposal locations

• Noise on river and water traffic

• Cleanup results & benefits
Truck route for dredged sediments (550 trucks/week)

Primary route

Secondary route

Disposal Site (for PCBs less than 50 ppm)

Map courtesy of STS/AECOM
Radar monitoring

Photos courtesy of TetraTech
Sediment disposal

• PCBs less than 50 ppm ("non-TSCA")
  – Local commercial facility
  – Disposal location: 34 miles
  – 3.6 million cubic yards

• PCBs more than 50 ppm ("TSCA")
  – Local disposal opposition
  – Disposal location: 460 miles
  – 180,000 cubic yards total
Noise & river traffic

• Noise solutions
  – Move operations or time differently
  – Add sound insulation

• In-river pipeline
  – Public education
  – Signs, buoys & markers
  – River patrols
## Progress on river cleanup

<table>
<thead>
<tr>
<th>River reach &amp; Phase</th>
<th>Start date</th>
<th>Completion date</th>
<th>Volumes addressed (cubic yards)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper river</td>
<td>2004</td>
<td>May 2009</td>
<td>750,000</td>
</tr>
<tr>
<td>Lower river</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 1</td>
<td>2007</td>
<td>2011</td>
<td>160,000</td>
</tr>
<tr>
<td>Phase 2</td>
<td>2009</td>
<td>2017</td>
<td>7,040,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>7,950,000</strong></td>
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2009 - 2010: 1,300,000 cy dredged
Results - upper river

- 370,000 cy PCB sediments removed & 500,000 cy capped (2004 – 2009)
- 95% of PCBs removed in 1–2 dredge passes
- Cost: ~$100 million
- Post-cleanup PCB concentration: 0.23 ppm average surface concentration from 3.7 ppm
Results for Upper river

PCB concentration (ppm)

Goal: 0.25 ppm

94% reduction
Post-cleanup PCB concentrations
Upper river (northern half)

2,422 sample locations for dredged areas

Figure 1-26, from: GW Partners, LLC, Remedial Action Certification of Completion Report, Lower Fox OU1, November 2010.
Local economic benefits

PCB removal dredges up work for local companies

River project has generated state, regional revenue

BY TONY WALTER
twalter@greenbaypressgazette.com

The negative environmental impact of PCBs in the Fox River is providing a positive economic result for many local companies. The 10-year project that includes removing polychlorinated biphenyl sediment from the Lower Fox, treating it in a process plant under construction, and hauling it to a Calumet County landfill has resulted in $200 million in contracts to local, regional and state companies, project officials say.

“We definitely wanted to hire local companies,” said Ray Mangrum, project manager for Tetra Tech, the company in charge of the river cleanup project. “We just bid it out to locals.”

Tetra Tech is supervising construction of a 247,800-square-foot processing facility on a 25-acre site on the river’s west side, just south of Georgia and countability.

The processing center is the first of its kind, something Mangrum said he designed on a napkin.

“Everybody in the world with a major sediment project will come here to see what’s going on,” said Stephen McGee, project coordinator for Tetra Tech.

They will see that the majority of the work is being provided by local companies and laborers. Mangrum said there will be about 140 workers on site through the winter and 85 to 100 working at the center when it becomes operational.

“We’ve worked all over the U.S. and these are the best

More online
For archived coverage, go to www.greenbaypressgazette.com/foxrivercleanup.

Feb. 2008 Green Bay Press Gazette

- $300 million+ contracts with local, state, & regional companies
- 140 jobs for initial construction & 85-100 ongoing (most local)
Additional local benefits

• Cleanup contractors spending
  – Hotels and restaurants
  – Local supplies
  – Home purchases, etc.

• River improvement
  – Tourism
  – Recreational
Natural Resource Damage compensation

• 110 projects funded (40 completed)
  – Land acquisition
  – Stream and wetland restoration
  – Land acquisition
  – Fish hatcheries
  – Public use

• $58 million spent to-date
  – $36 million by Potentially Responsible Parties
  – $22 million by governmental parties