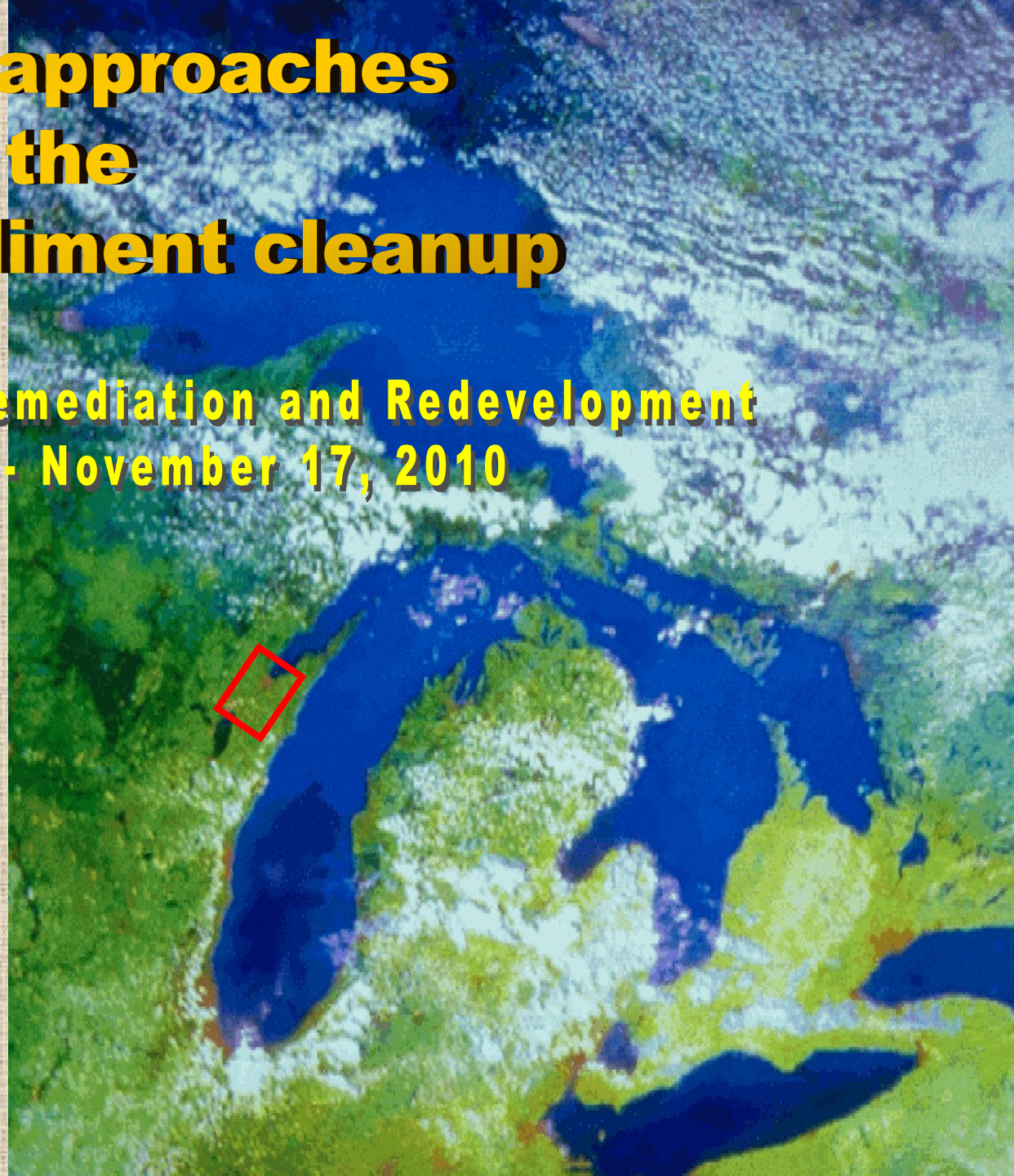


Innovative approaches on the Fox River sediment cleanup

**WDNR Bureau for Remediation and Redevelopment
Statewide Training - November 17, 2010**

**James Hahnenberg
U.S. EPA
November 16, 2010**



Today's topics

- **Innovative & unique aspects of the Fox River project**
- **River cleanup**
- **Issues & controversies**
- **Results**

Fox River PCB cleanup

- **Largest environmental sediment cleanup**
- **\$800 million cleanup cost**
- **Collaborative team: Agencies & companies**
- **Agency oversight team: cleanup plan improvements**
- **Long-term monitoring plan**

Innovations - Fox River

- **Annual Work Plans**
- **Infill sampling of dredge areas - from 7 samples/acre to 28 samples/acre**
- **Dredge: GPS – RTK control system**
- **Neatline dredging**

Innovations - Fox River

- **Multiple hydraulic dredges**
- **Vic Vac® dredge**
- **Geotextile tubes for dewatering**
- **Beneficial sand re-use**
- **Cap placement method**

Fox team

	Upper river	Lower river
Agencies	WDNR* & EPA	
Agencies oversight	Boldt, NRT, et al	
PRPs	Glatfelter WTMI Menasha	API NCR GP
PRP contractors	Brennan CH2MHILL Foth	Tetrattech Brennan Boskalis-Dolman

* Technical lead

Agency oversight team



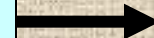
Photo courtesy of Boldt

Fox cleanup decisions

2002/2003

Decisions

Dredging/disposal
(with capping contingency)



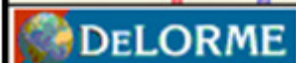
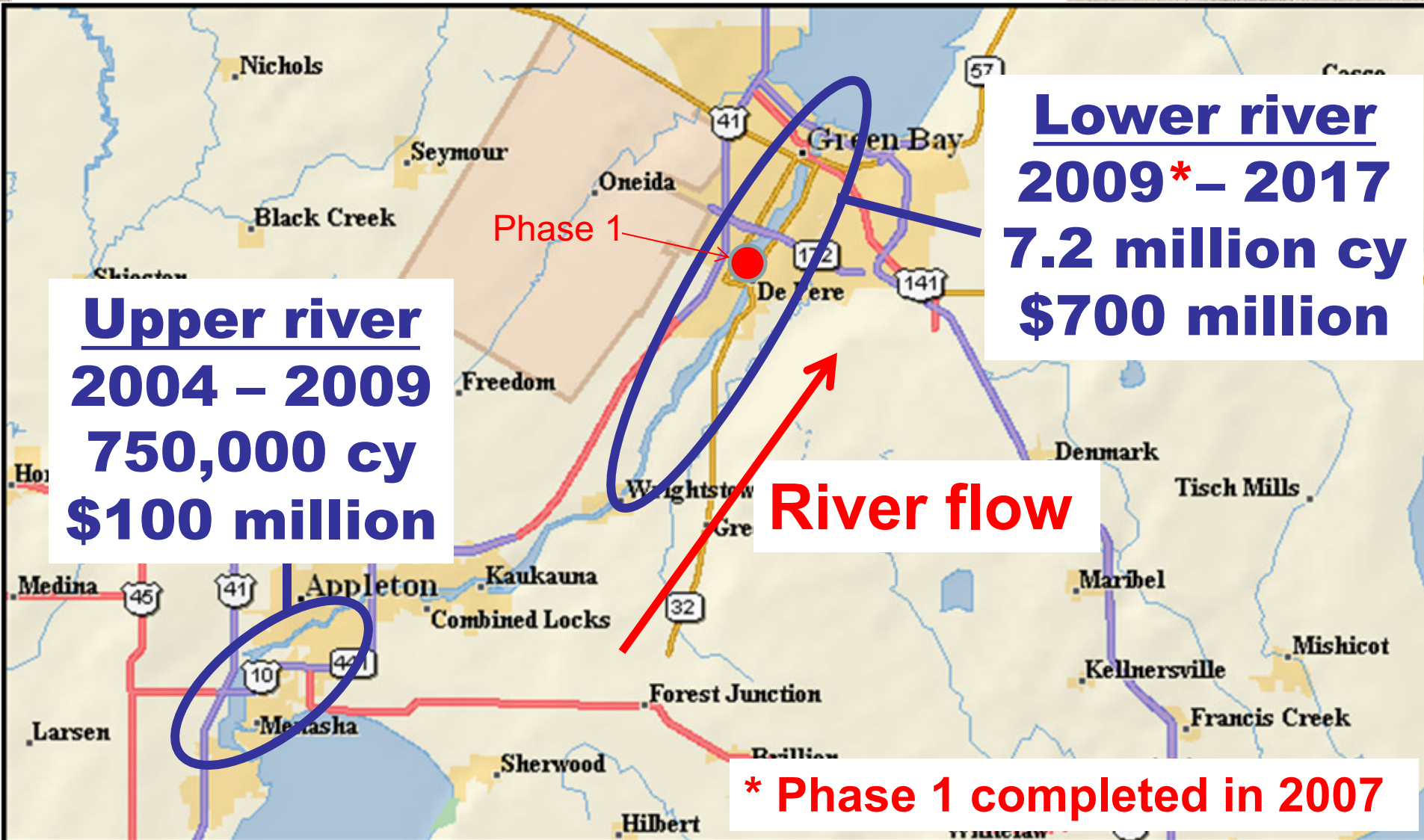
2007/2008

Decision Amendments

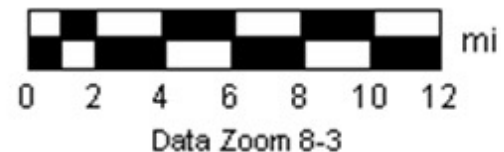
Dredging/disposal
Engineered caps
Sand covers
Long-term cap
monitoring &
maintenance

PCB Action Level: 1 ppm

Fox River and Green Bay Site



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Cleanup actions upper river

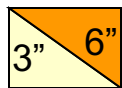
Legend



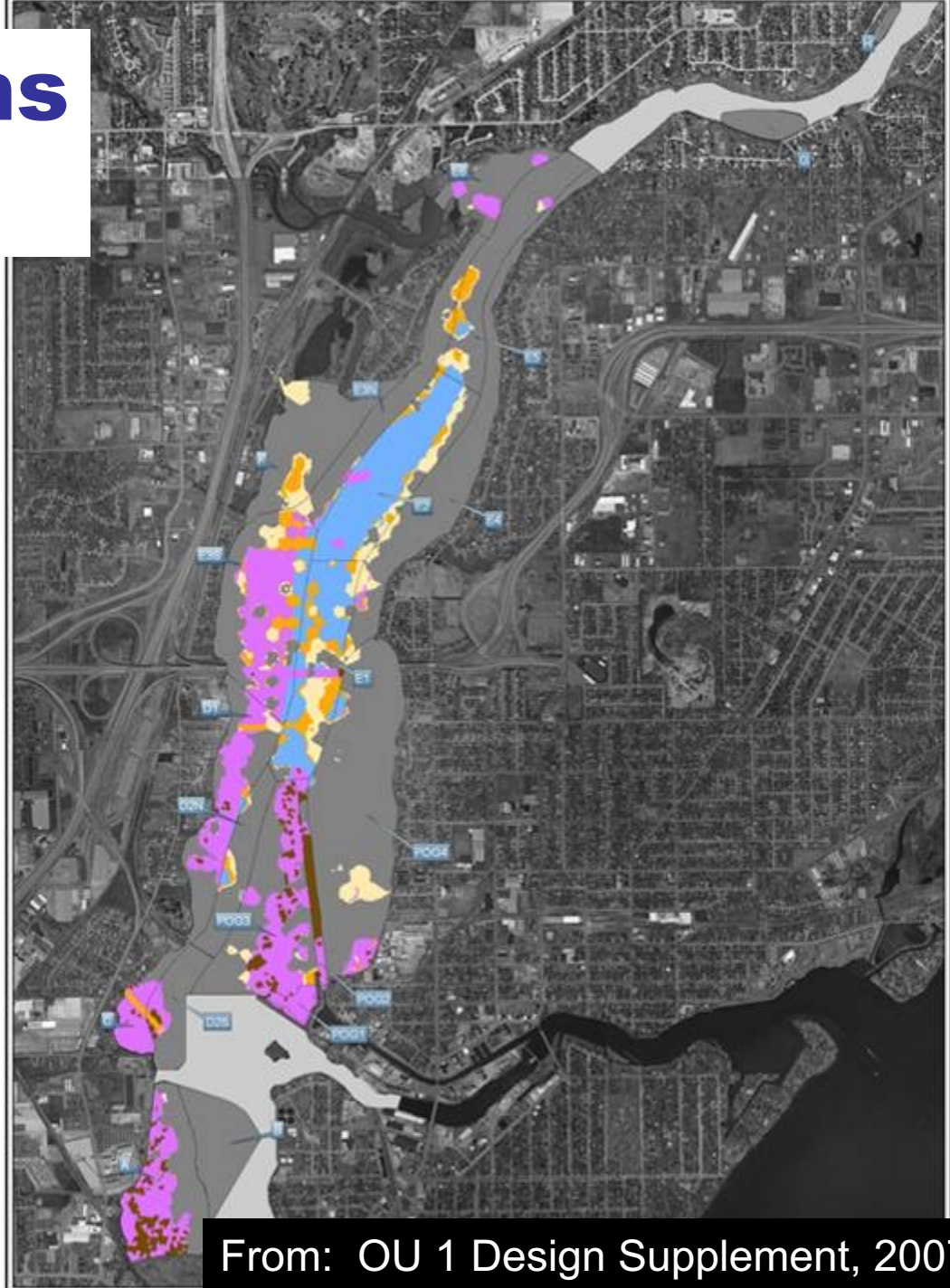
Dredging



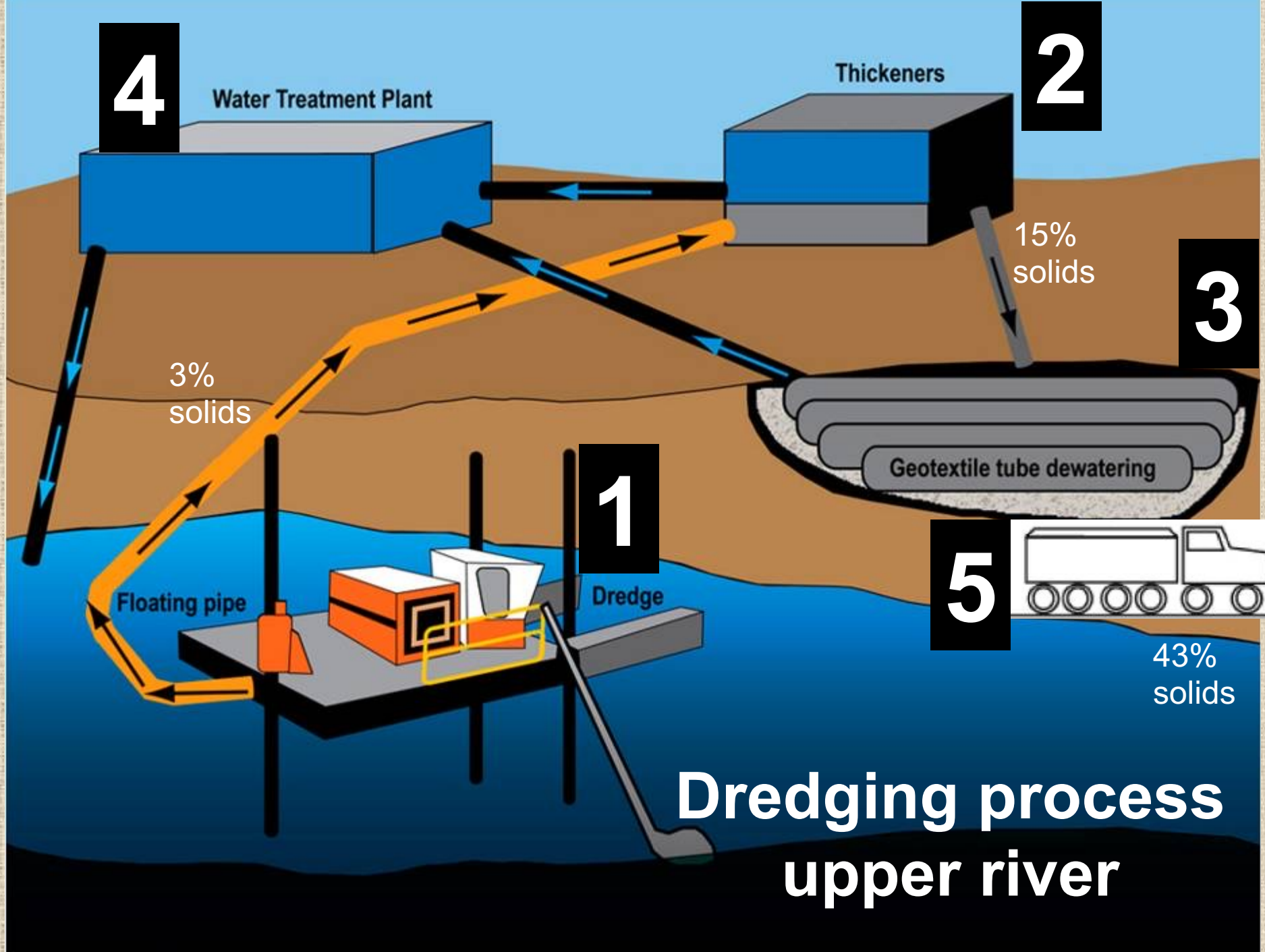
Capping



Sand cover



From: OU 1 Design Supplement, 2007



“Small” cutterhead dredge



Photo courtesy of Boldt

Dredge operator controls: GPS – RTK

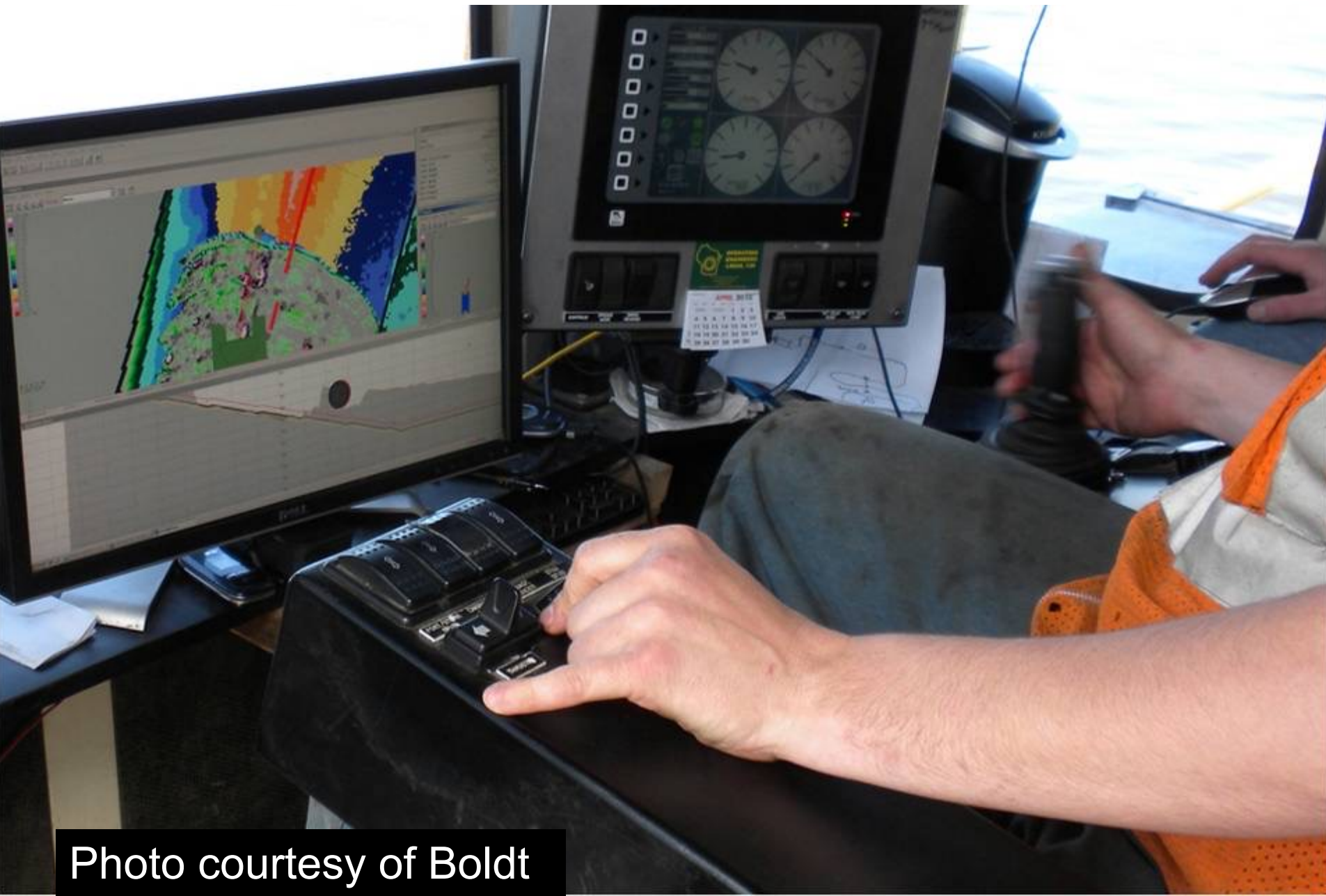


Photo courtesy of Boldt

Monitor for dredge operator

Dredge arm

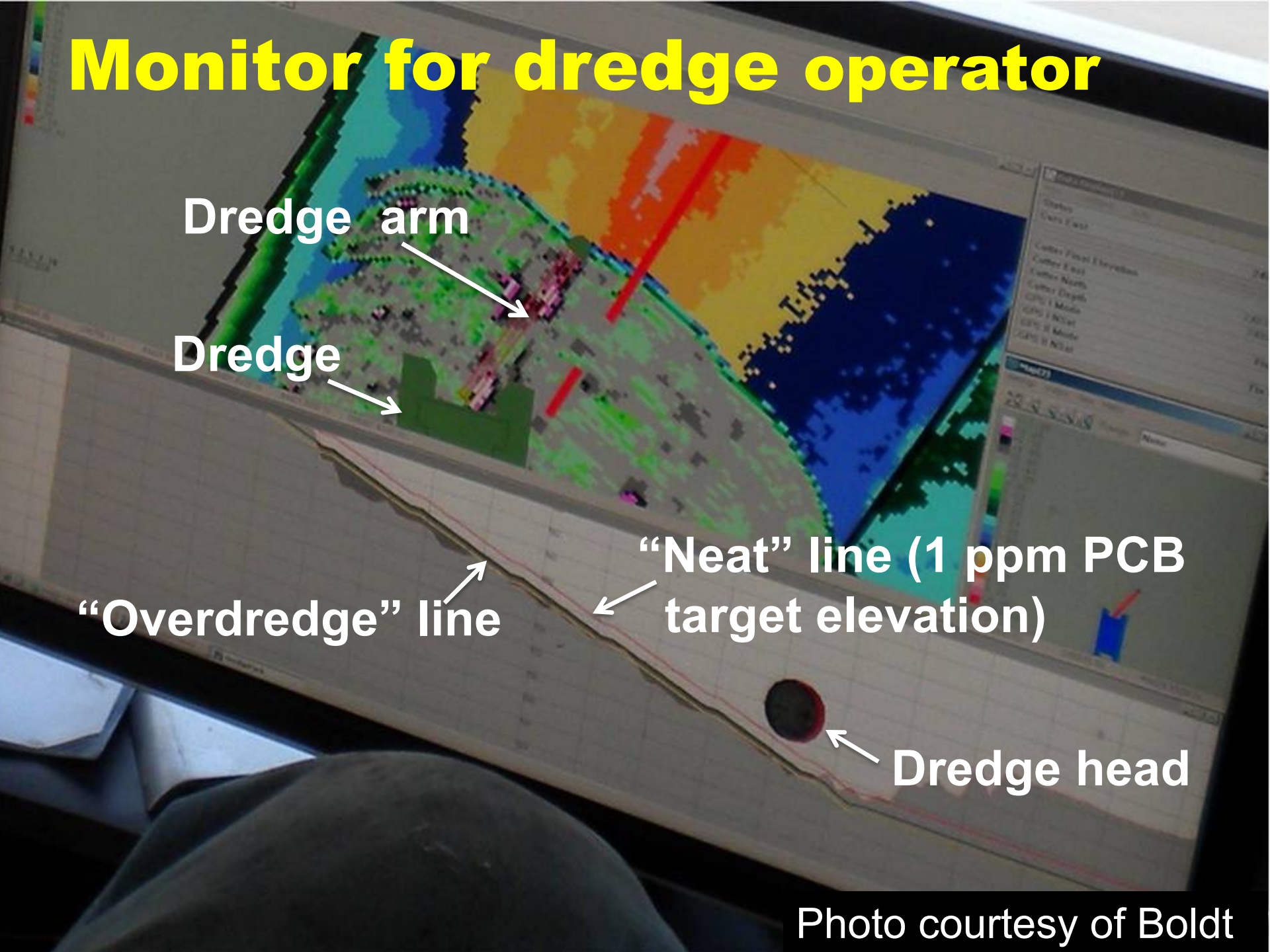
Dredge

“Overdredge” line

“Neat” line (1 ppm PCB target elevation)

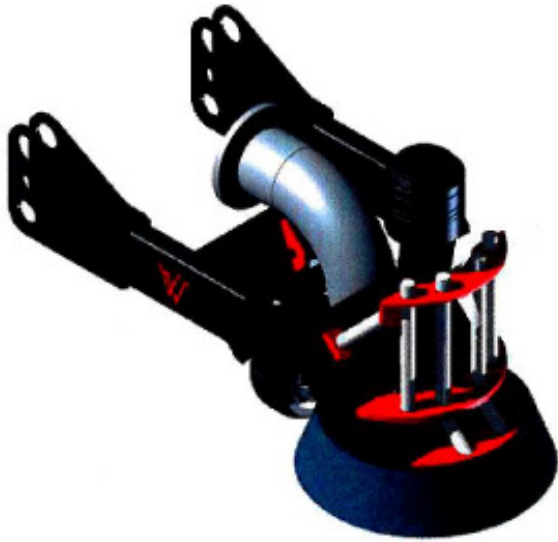
Dredge head

Photo courtesy of Boldt

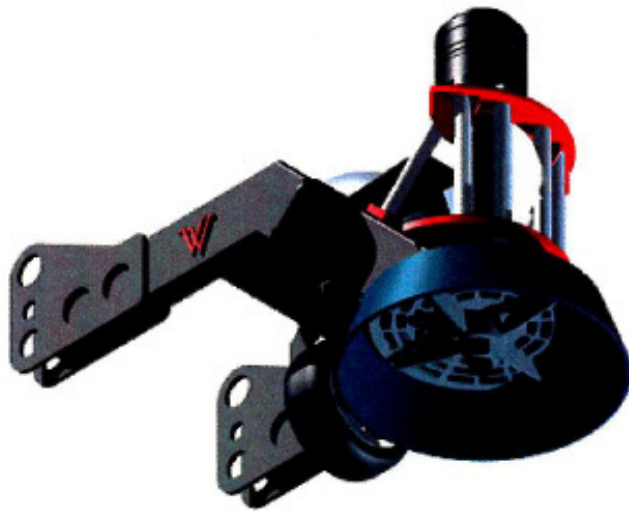


Vic Vac® dredge

- For thin sediment over clay or bedrock
- Lower final PCB concentrations



Isometric View From Top



Isometric View From Bottom

Courtesy of Brennan

Dredging

**2004 – 2008 dredging
upper river**

Dewatering (geotextile tubes)



Loading

Disposal



Photos courtesy of Boldt

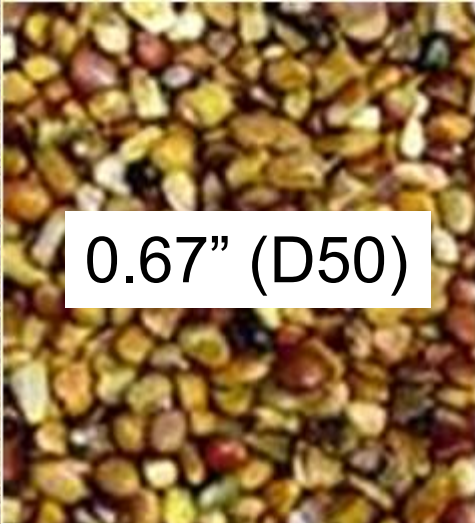
Geotextile tubes

**Solids captured
& water drains
out**

Slurry from thickeners/dredges



Cap example



0.67" (D50)

7" stone

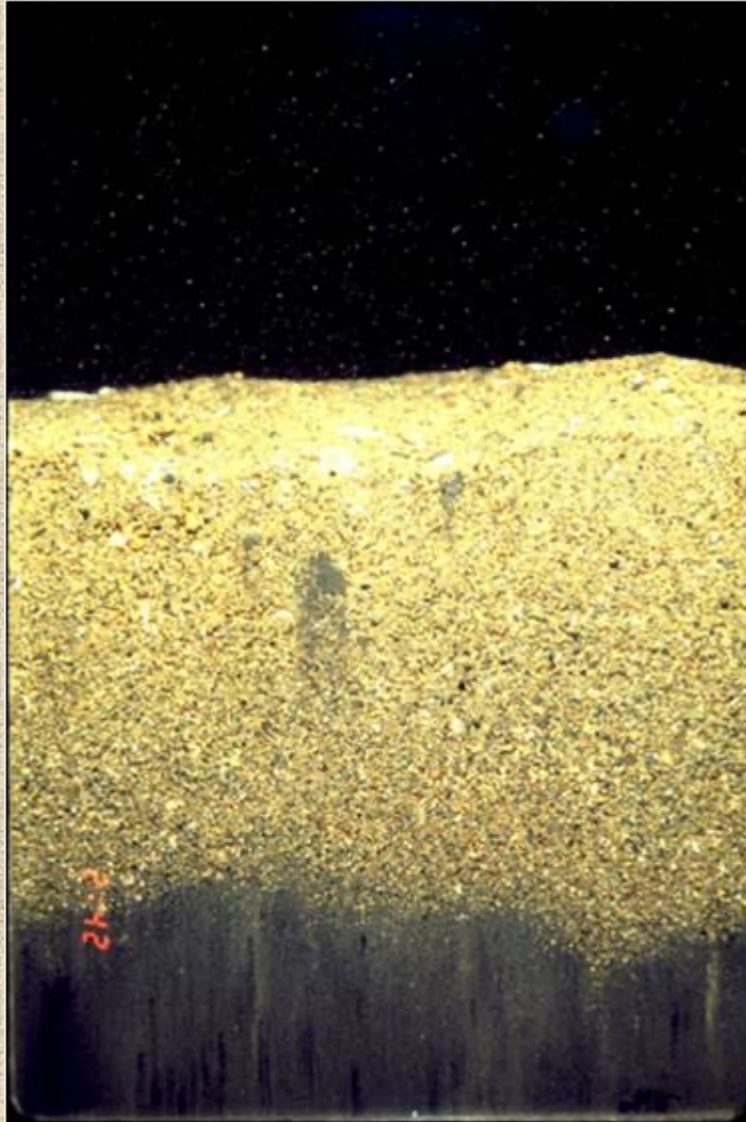


6" sand



PCB contaminated sediment

Sand cover



Mixing
zone {

**6-inch
sand cover**

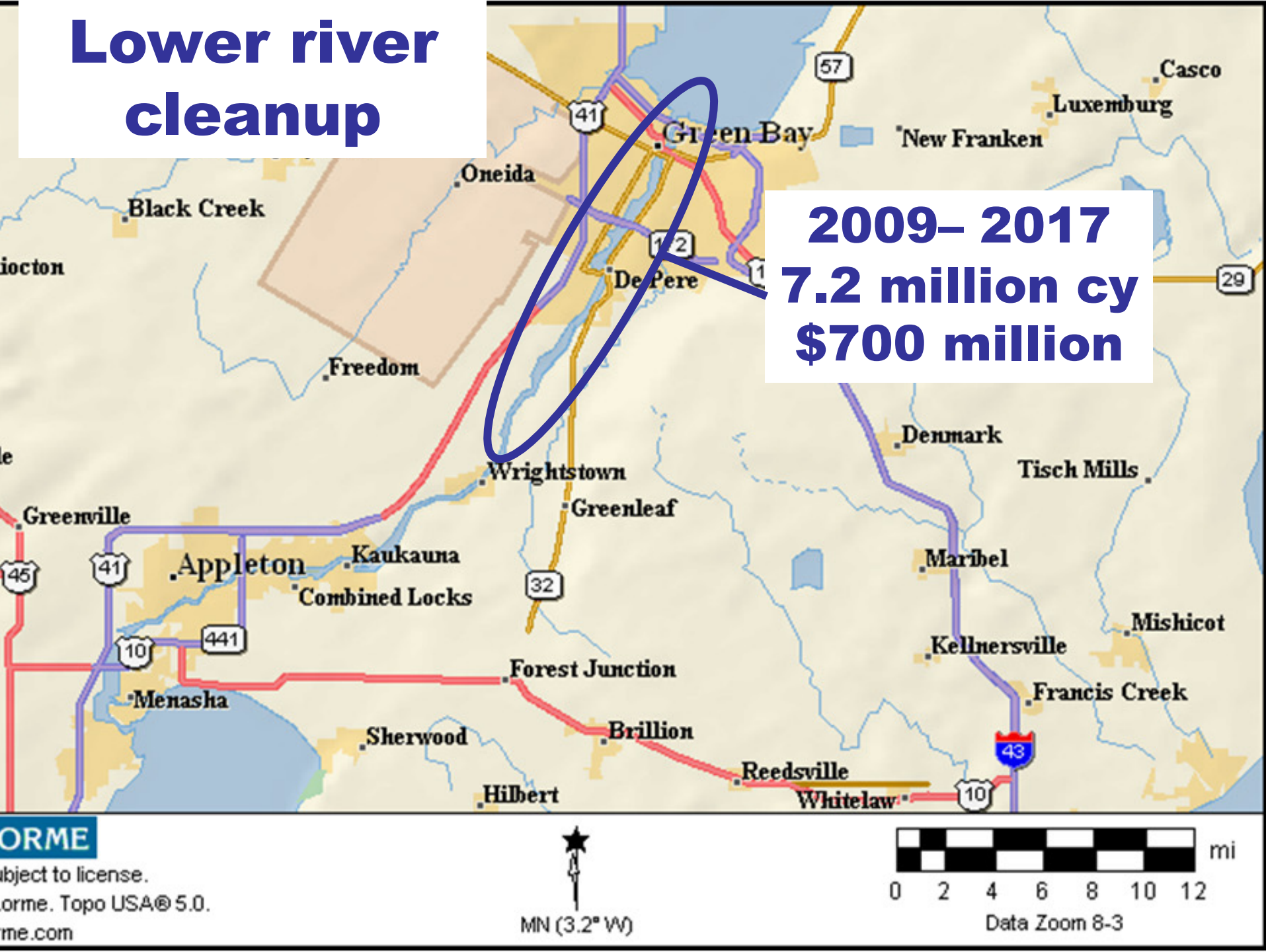
**Contaminated
sediment**

**“Throwing stone”
(cap armor stone)**



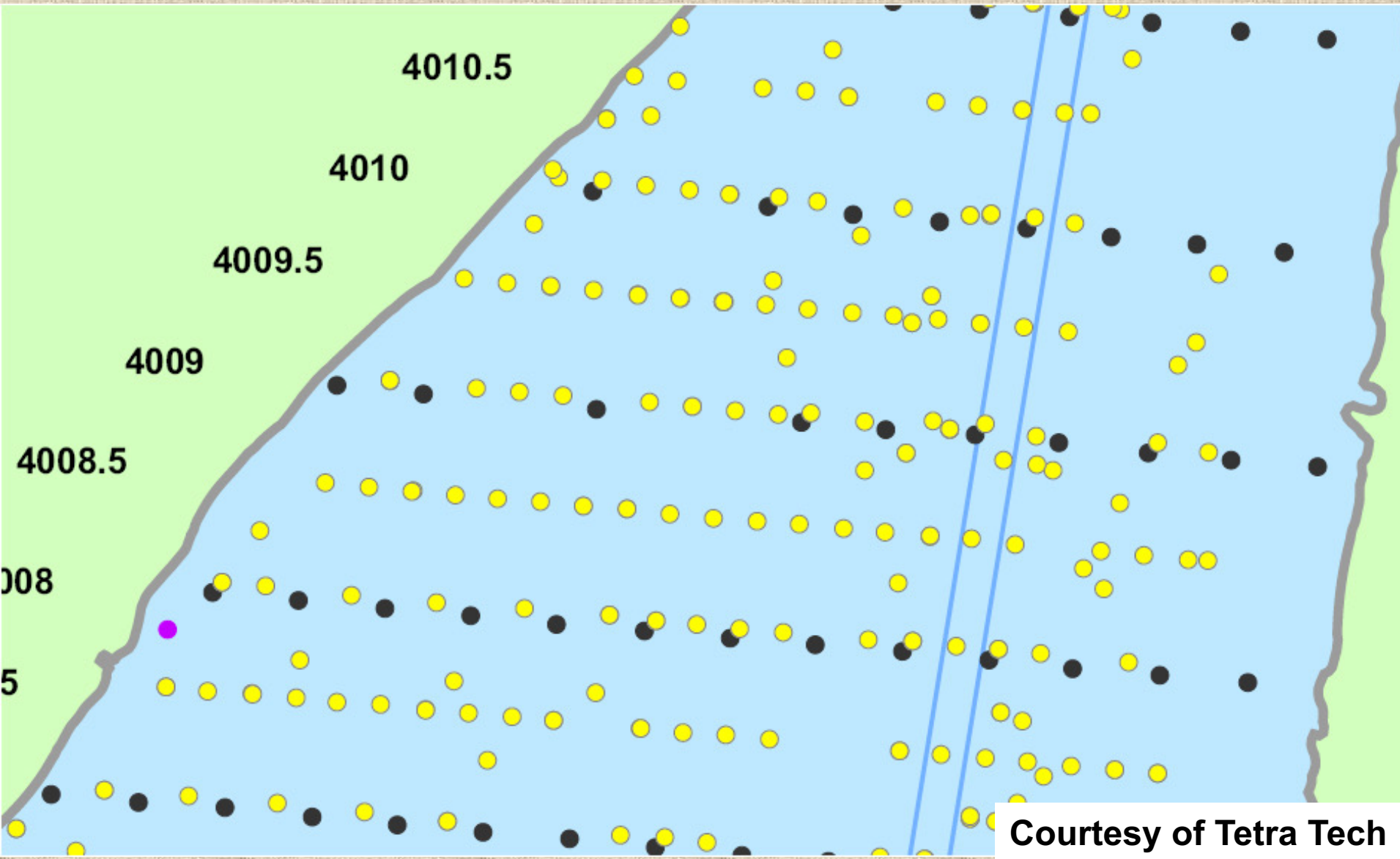
Photo courtesy of Boldt

Lower river cleanup



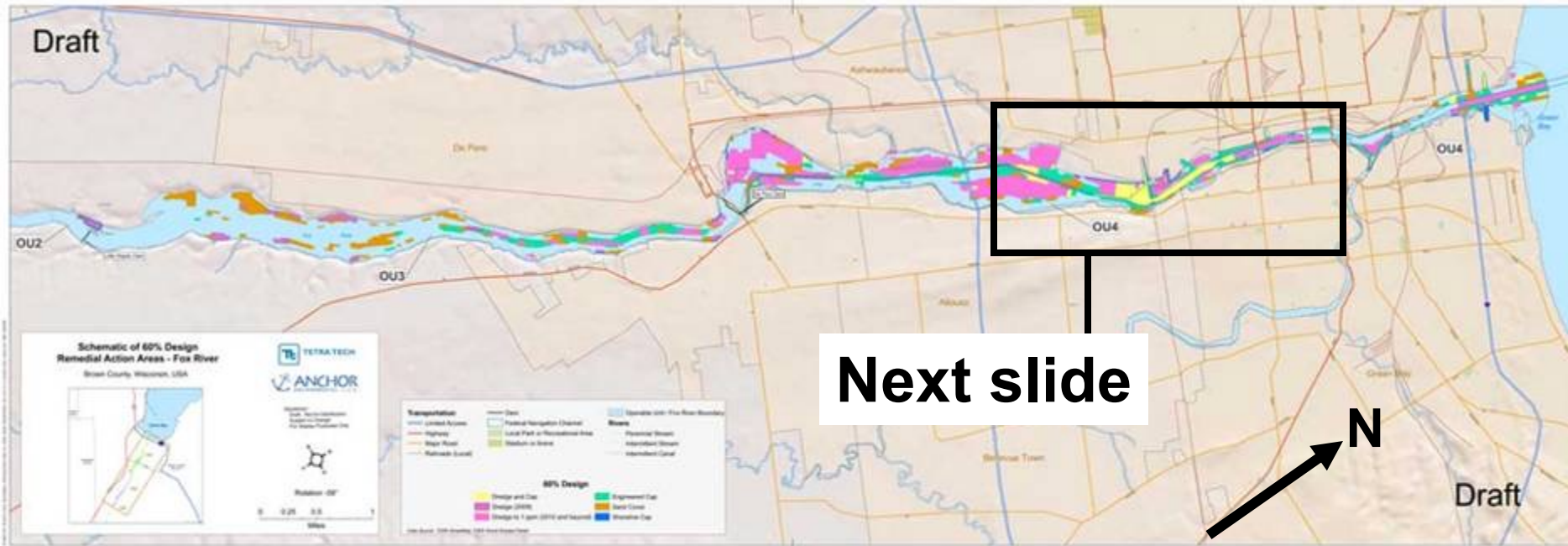
Infill sampling lower river

- 2010 sampling
- 2004 - 2006 sampling

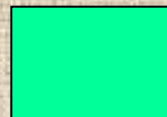


Courtesy of Tetra Tech

Lower river cleanup actions



Dredging



Cap (sand and gravel)



**Dredge
and Cap**

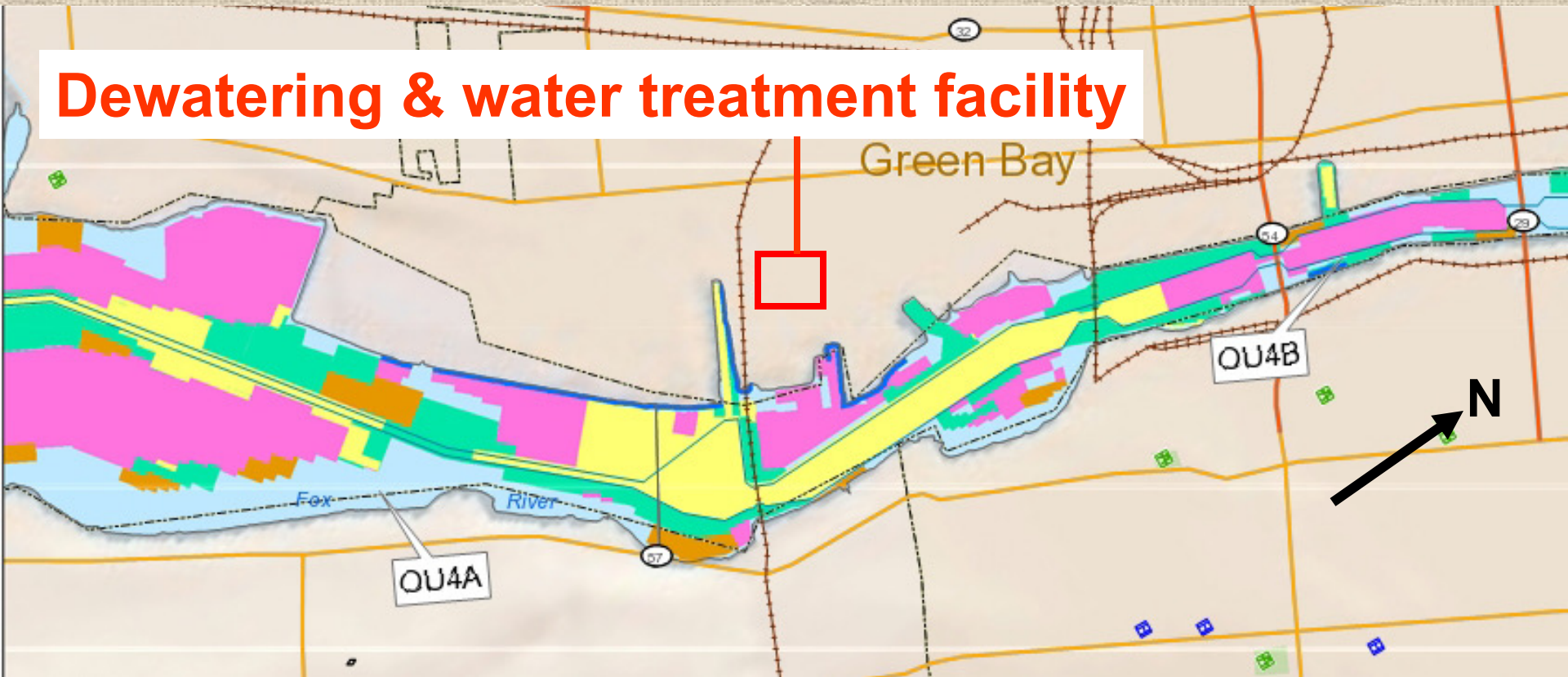


Cover (sand only)

Courtesy of Tetra Tech

Lower river cleanup actions


Dewatering & water treatment facility



 Dredging

 Cap (sand and gravel)

 Dredge and cap

 Cover (sand only)

Courtesy of Tetra Tech

Dewatering facility for lower river cleanup



From: TetraTech weekly QC report

Dewatering facility for lower river cleanup



Photo courtesy of TetraTech

Multiple hydraulic dredges

Output pipe size	Auger size	Contamination thickness	No. dredges
8" ("small")	24"	2 - 3 feet	2
12" ("large")	36"	3 - 12 feet	1

A large industrial facility, likely a water treatment plant, featuring a prominent yellow overhead crane with the brand name "EMH" visible. In the foreground, a large circular tank, identified as a pre-thickener, is partially filled with a grey slurry. The tank has a metal walkway with railings around its perimeter. In the background, various industrial structures, pipes, and storage areas are visible under a high ceiling with a grid of lights.

Plate and frame presses

Pre-thickener

Photos courtesy of TetraTech

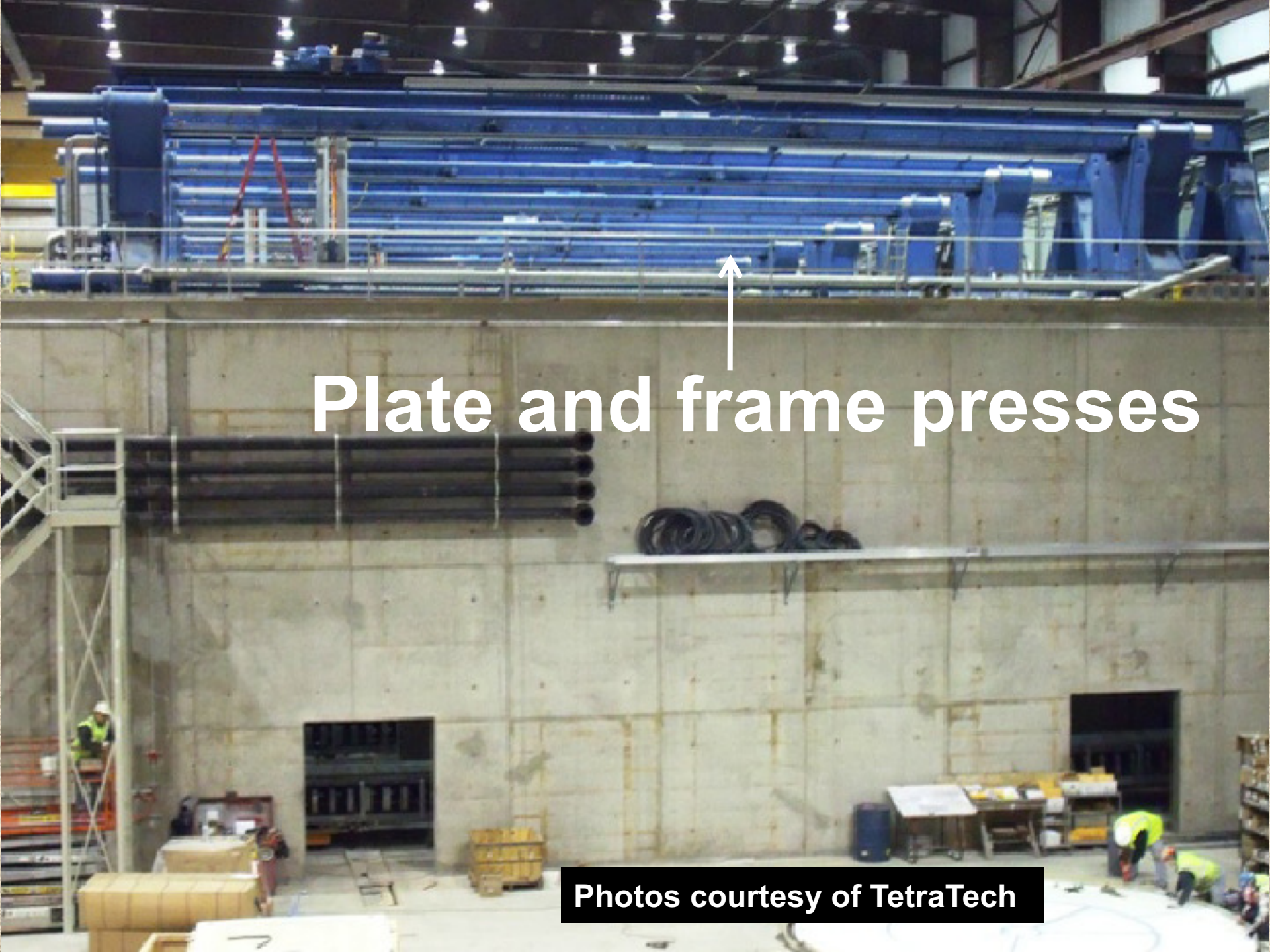
A photograph of a large industrial facility, likely a shipyard or a large-scale manufacturing plant. The upper portion of the image shows a complex blue overhead crane system with multiple parallel beams and trolleys, spanning across the top of the frame. Below this, a large, light-colored concrete wall dominates the middle section. On the left side of the wall, several dark, horizontal pipes or conduits are visible. To the right of these, a metal shelf holds several coiled black hoses. The floor of the facility is cluttered with various items, including cardboard boxes, a blue barrel, and some equipment. In the bottom right corner, two workers wearing high-visibility yellow vests are visible, working on the floor. The overall scene is brightly lit by overhead industrial lights.

Plate and frame presses

Photos courtesy of TetraTech

Plate and frame presses

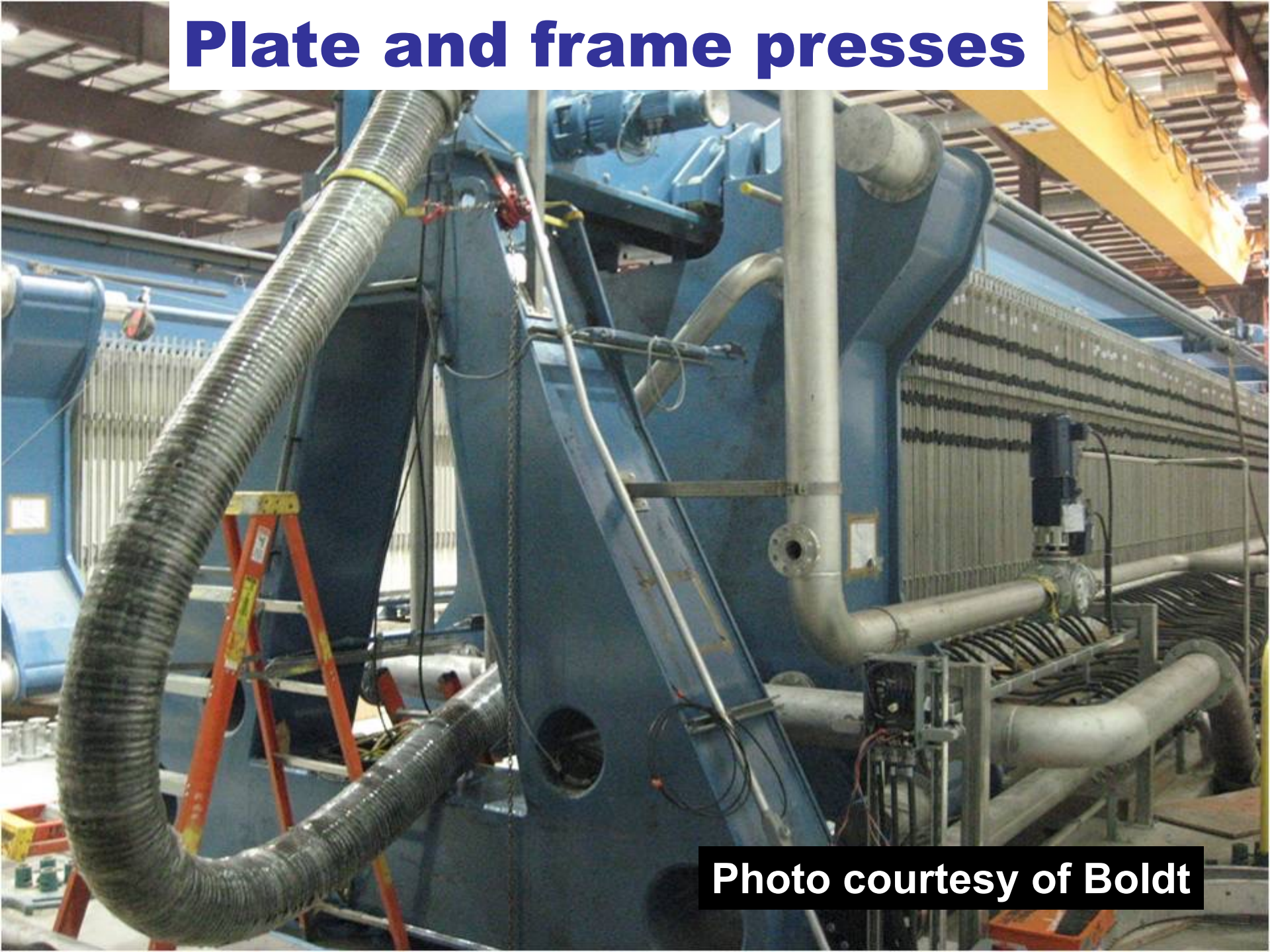


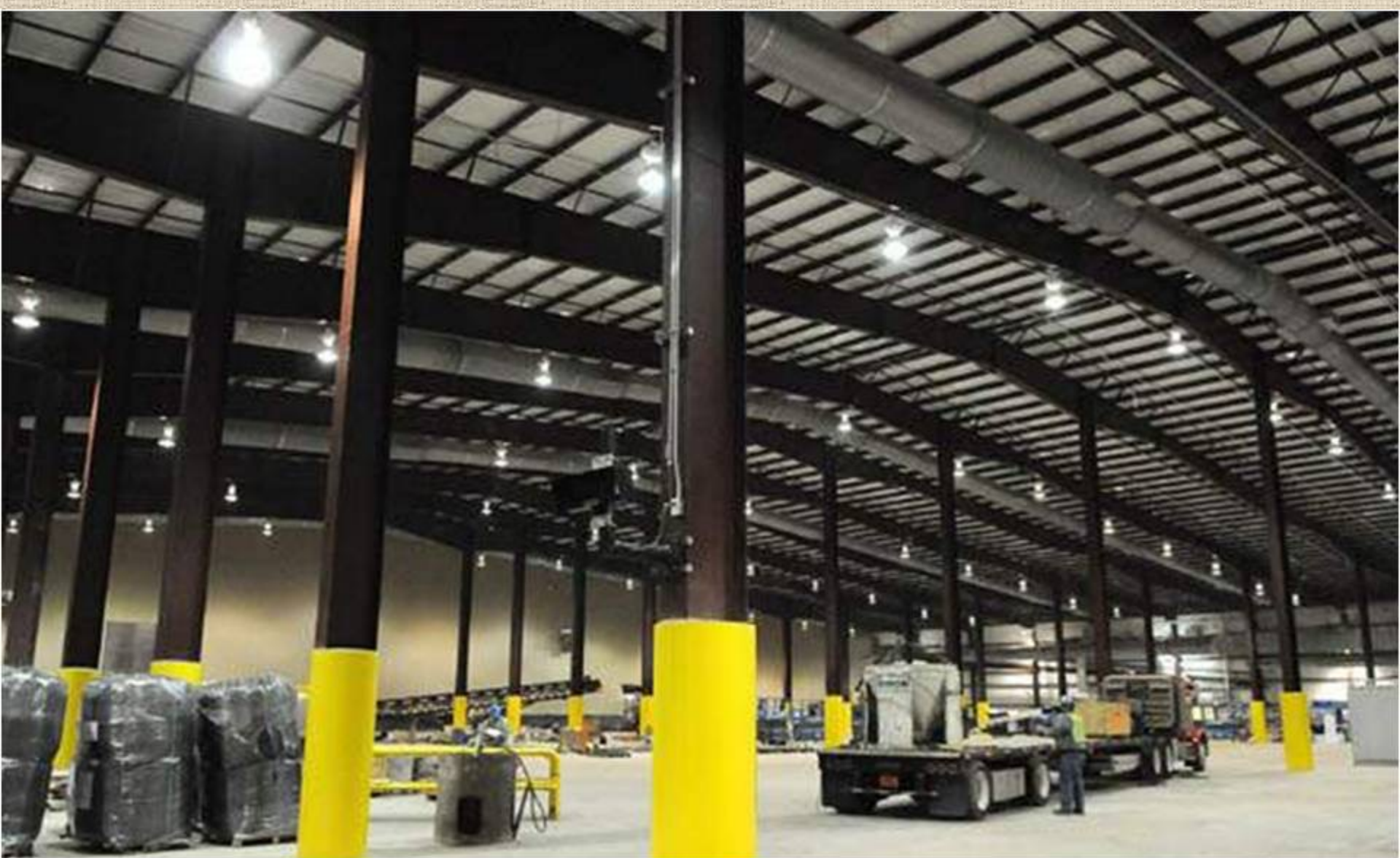
Photo courtesy of Boldt

Dewatering plant monitors



Photo courtesy of Boldt

Sediment storage area



Green Bay Press Gazette photo

Pipeline to river for treated water



Green Bay Press Gazette photo

Air filters



Photo courtesy of Boldt

Sediment disposal



Photo courtesy of Boldt

“Beneficial re-use” of sand

2010: 35,000 tons of sand of 300,000 tons sediment - roadway construction

Possible opportunity	Description of use	Estimated PCB concentrations
Bayport disposal facility	Construction	≤ 1 ppm
Landfill	Construction	≤ 5 ppm
Roadways	Construction	≤ 1 ppm
Mines	Reclamation	≤ 0.25 ppm
Upland	Construction for non-residential uses	≤ 1 ppm

Photo courtesy of Boldt

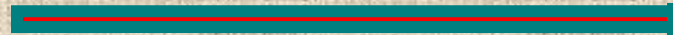
Progress

River reach & Phase		Start date	Completion date	Volumes addressed (cubic yards)
Upper river		2004	May 2009	750,000
Lower river	Phase 1	2007	2011	160,000
	Phase 2	2009	2017	7,040,000
TOTAL				7,950,000

2009 - 2010: 1,200,000 cy dredged

Fox Cleanup Timeline

Lower river cap/cover



Lower river dredging



Upper river



2005

2010

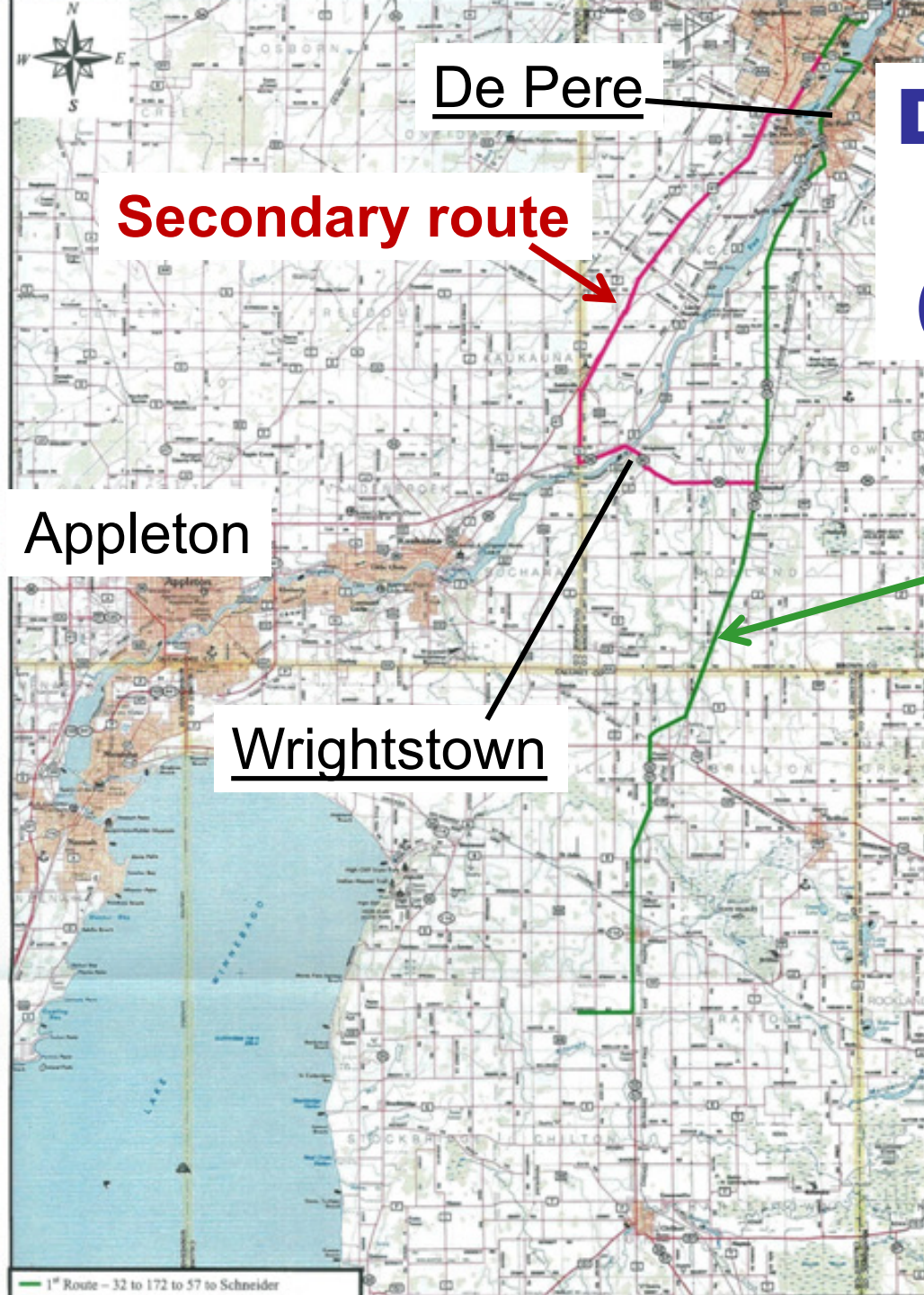
2015

2020

Year

Issues & Controversies

- **Transportation & Disposal**
- **Corps navigation dredging coordination**
- **Long-term cap stability & monitoring**



**Dewatering facility
to disposal site
(550 trucks/week)**

Primary route

Map courtesy of STS/AECOM

Radar monitoring of trucks



Photos courtesy of TetraTech

Navigation dredging news coverage



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Port of Green Bay concerned that order to halt dredging of PCBs on Fox River will harm shipping

BY TONY WALTER • TWALTER@GREENBAYPRESSGAZETTE.COM • OCTOBER 14, 2009

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The U.S. Department of Justice has ordered the Army Corps of Engineers to halt dredging in the 3.3-mile Fox River navigational channel through downtown Green Bay, a move it says will prevent the spread of PCB sediment, but that port officials say could seriously hurt the shipping business.

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County officials say they also are concerned that the Fox River cleanup project's final design plan, expected to be completed in early 2010, might include placing sand and gravel over contaminated river bottom in the two places where large ships need to turn around, which could hinder their movements.

But Bruce Baker, deputy administrator of the DNR's water division, said



The lakes carrier Arthur M. Anderson unloads coal Thursday at the C. Reiss Coal Co. in Green Bay. H. Marc Larson/Press-Gazette

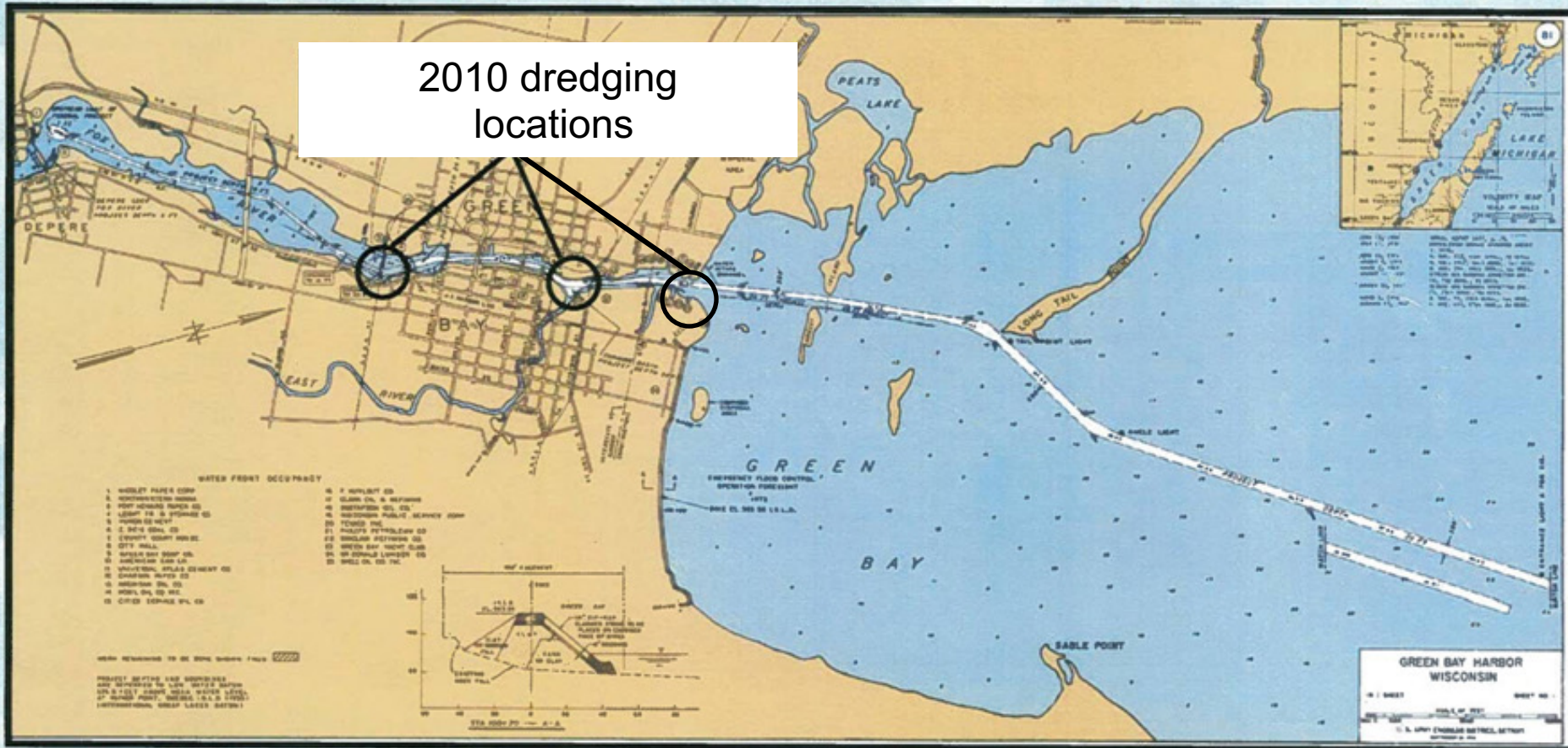
Areas of concern



ON THE WFR

Green Bay Harbor 2010 navigation dredging

2010 dredging
locations



Environmental cutterhead dredge



Environmental navigation dredge



Photos courtesy of Boldt

Cap Stability

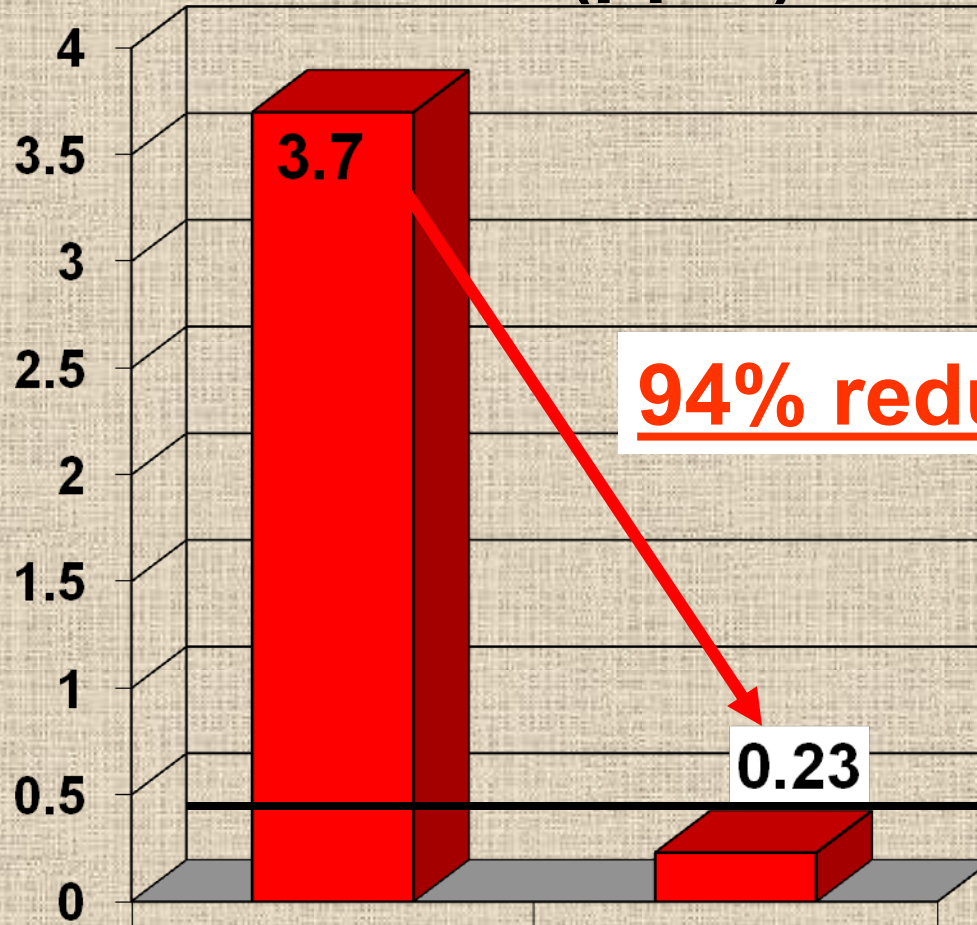
- **Erosion protection: stone and gravel**
- **No caps in areas of possible ice effects**
- **Bioturbator effects considered**
- **Experience on capping projects**
- **Monitoring and maintenance**

Cap Monitoring

- **Geophysical (e.g., bathymetry)**
- **Cap coring and analysis: ~ 20 locations**
- **Years 2, 4 and every 5 years**
- **Trigger events – additional monitoring**

Upper river results (SWAC)

PCB concentration (ppm)



Before

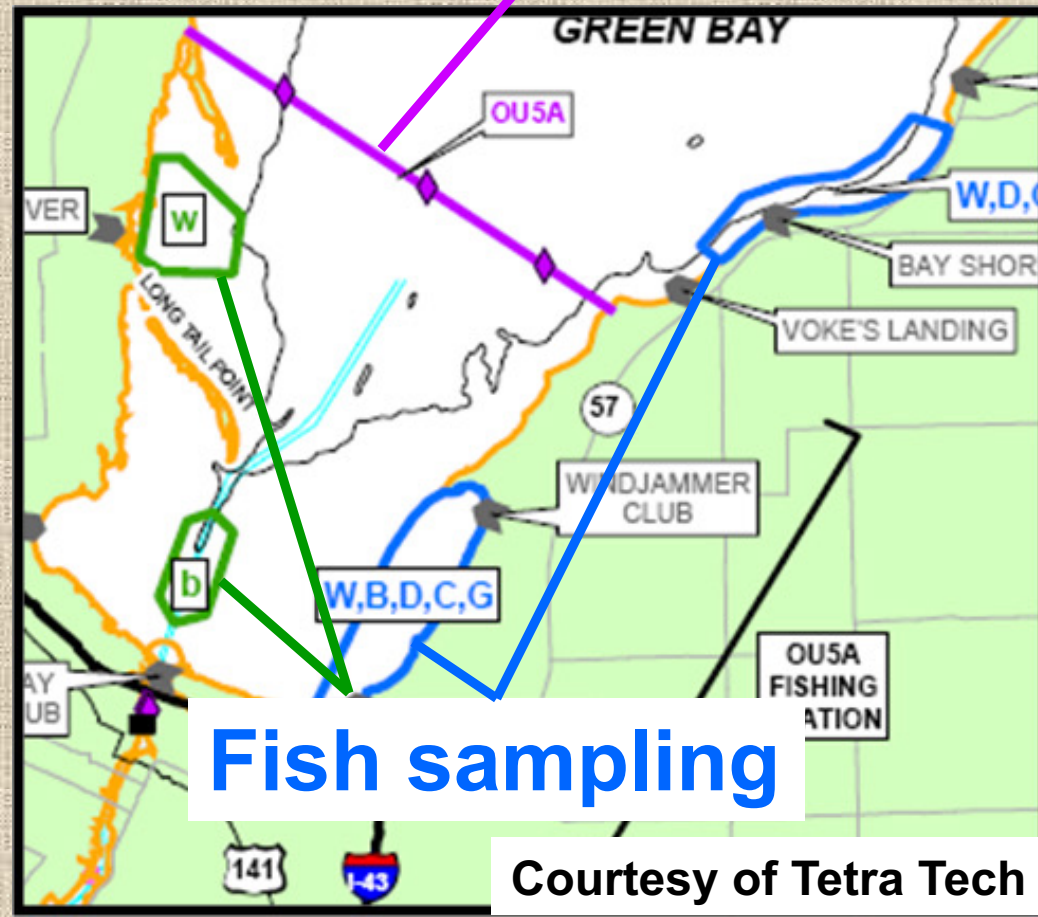
After

Goal: 0.25 ppm

Long-term Environmental Monitoring

- Sediments
- Surface water
- Fish
 - Walleye or Bass
 - Carp or Drum
 - Gizzard Shad

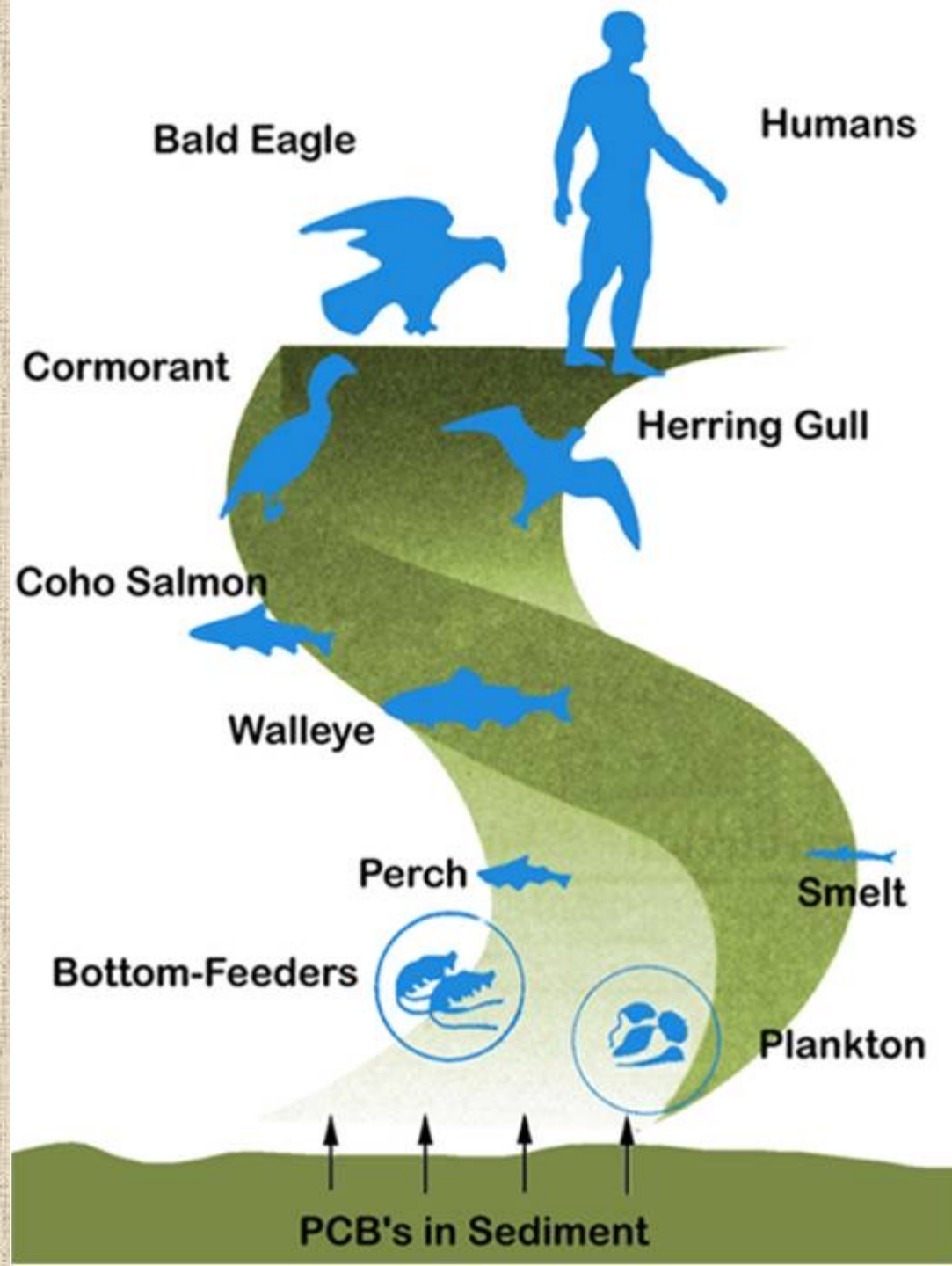
Surface water
transect



Courtesy of Tetra Tech

PCBs in foodchain

- Human health
 - Cancer
 - Non-cancer
- Ecosystem





Questions, discussion