



Field Studies of Reactive Capping Technologies

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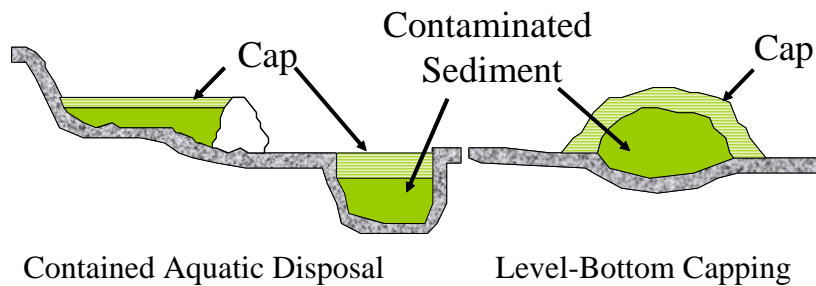
reactive capping, contaminated sediment, in situ treatment



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In Situ Capping



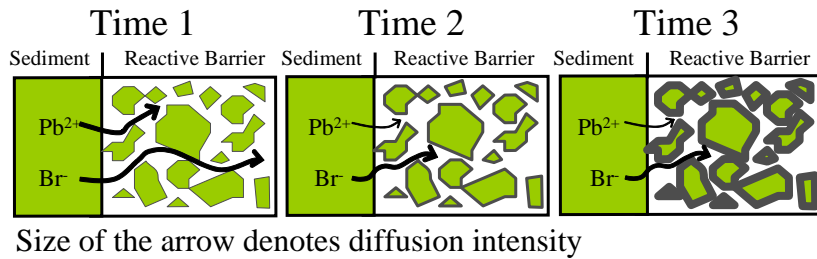
After Figure 1, USACE TR DOER-1

Caps can be reactive or non-reactive!



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Reactive Barrier Concept (Heavy Metal Contaminant)



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Potential Reactive Cap Materials

- Activated Carbon
- Zero Valent Iron (ZVI) & Magnesium/Palladium
- Organoclays
- Apatite – Natural phosphate mineral
- Coke Breeze – Coke byproduct
- Bauxite
- AquaBlok™

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Do These Materials Work?

Are these materials a:
Viable Technology

or

Magic Fairy Dust?

Need Field Validation!

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Anacostia River Capping Demonstration



US Environmental Protection Agency (US EPA)



Louisianan State University HSRC/S&SW



UNH CSC



CICEET
Cooperative Institute for Coastal and Estuarine Environmental Technology (UNH and NOAA)

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U.S. Environmental Protection Agency
EPA-600/3-01/001a



What is the Anacostia River Demonstration?

- Field scale demonstration of promising in situ reactive capping technologies
- Four caps: AquaBlok™, coke breeze, apatite and control sand cap
- Demonstration looks at cost, ease of deployment and short term mechanical and environmental performance
- Doesn't directly compare each technology because they work differently and treat different contaminants

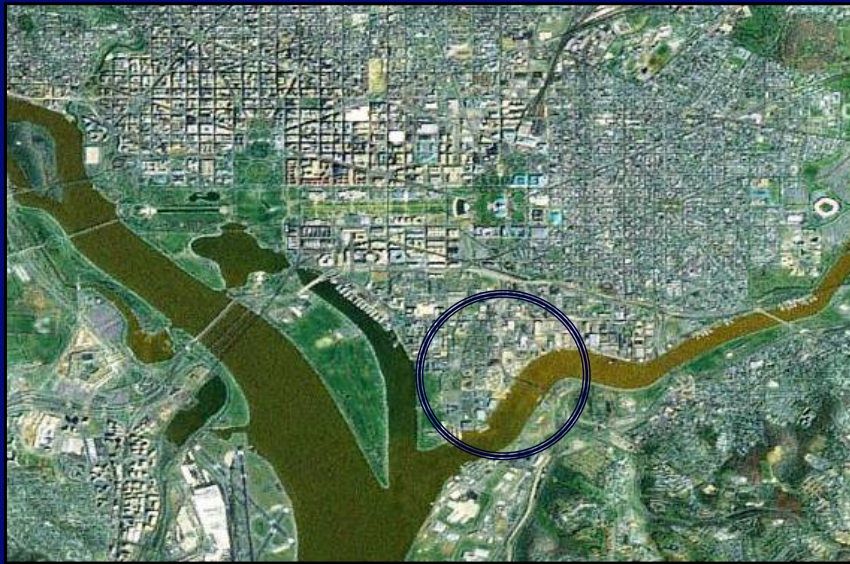
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Demonstration Site



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What are the Materials?

- Apatite – Phosphate sand from NC, works well on heavy metals.
- Coke – Carbon based material that is good for organic contaminants.
- AquaBloK™ - Composite particle with a solid core and clay/polymer coating. Forms impermeable layer.
- Sand – Clean sand for comparison.



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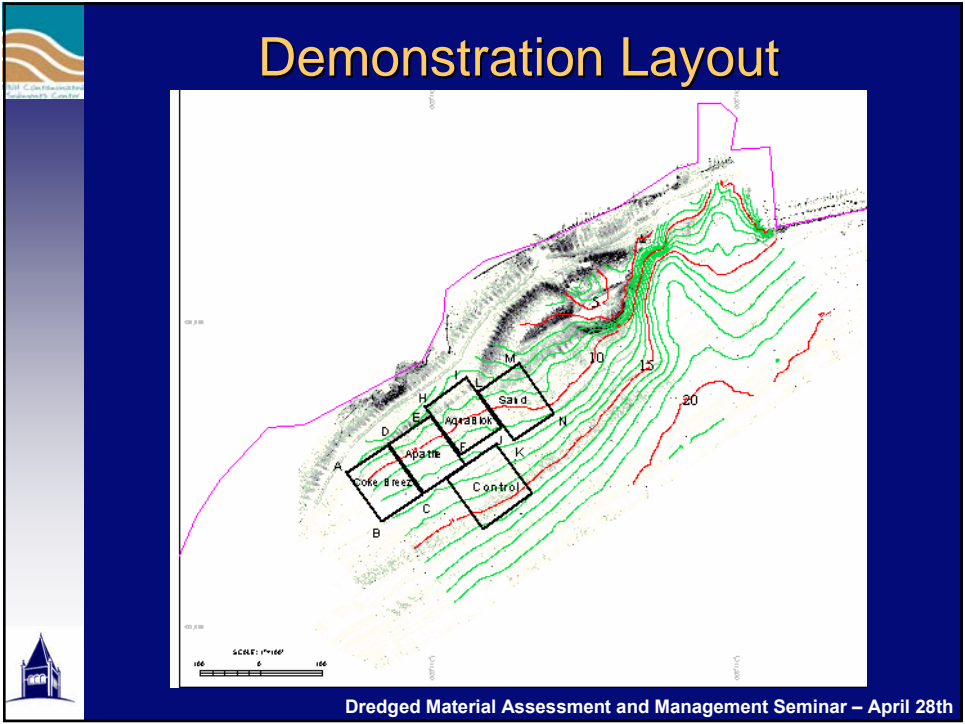


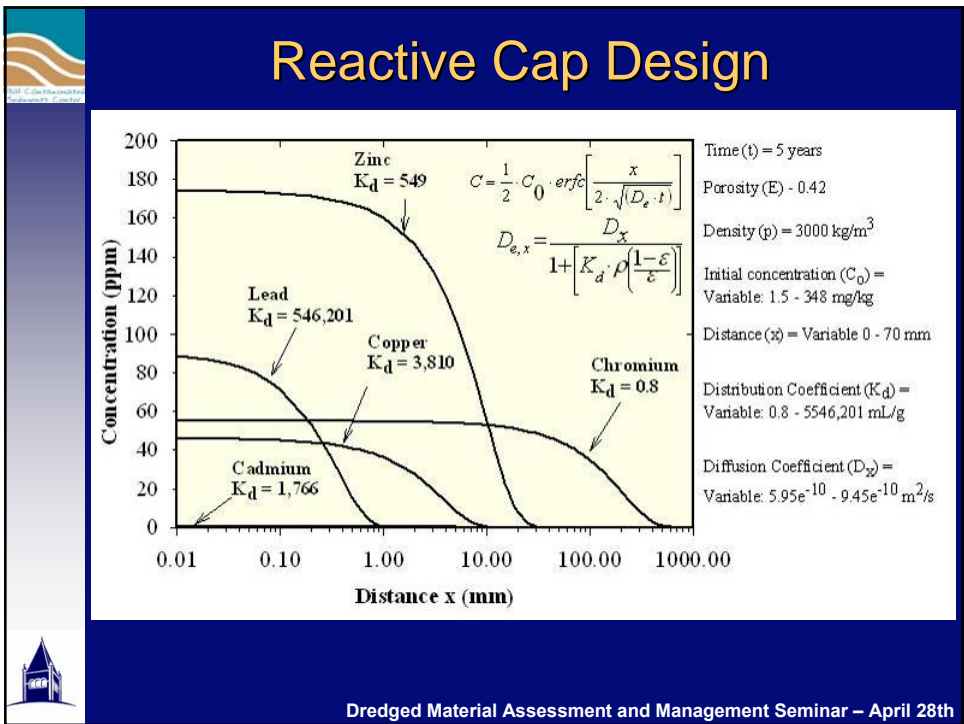
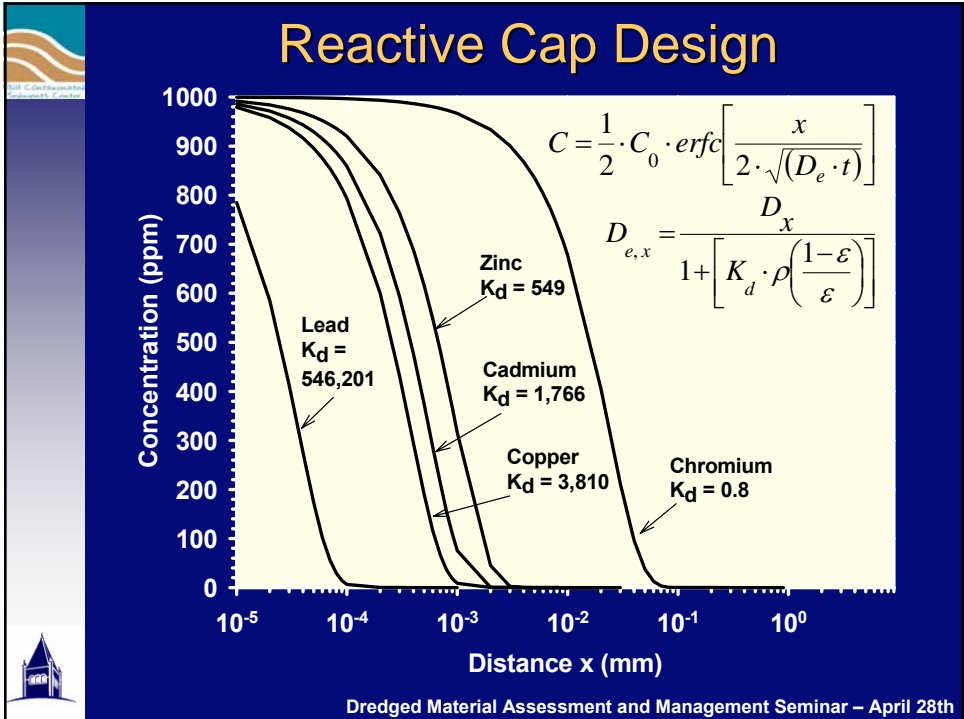
Demonstration Work Plan

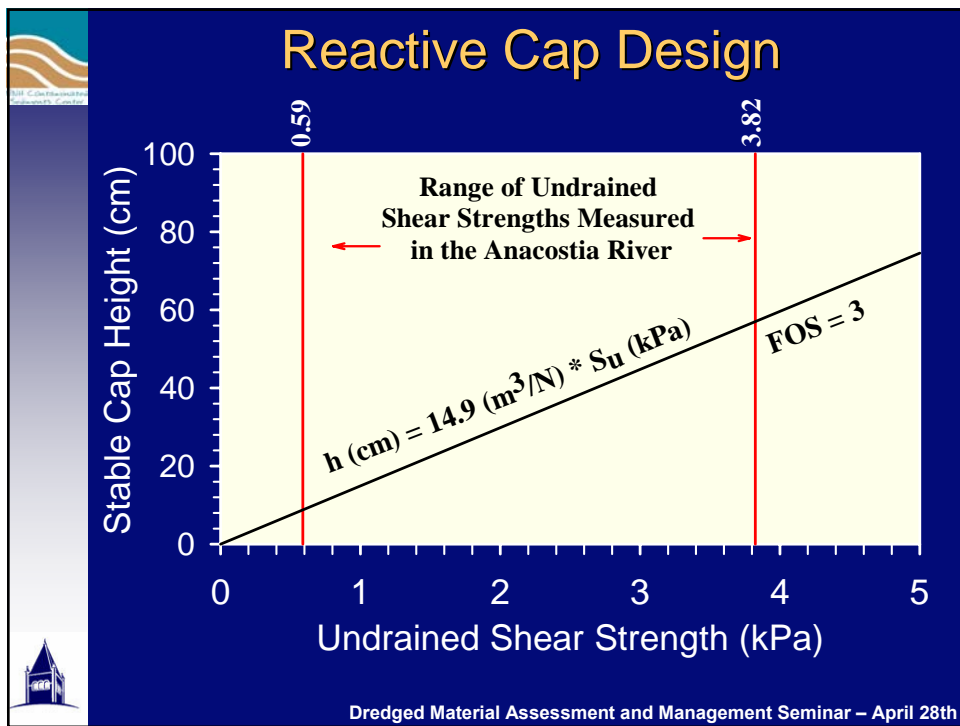
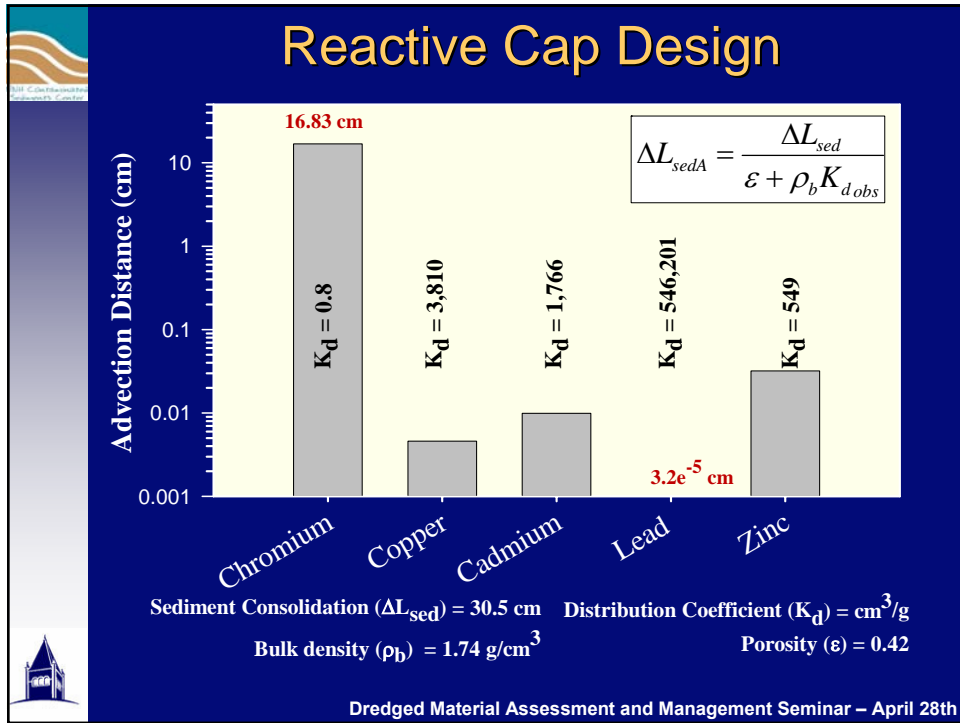
- Site Characterization
- Cap Design
- **PERMITTING**
- Deployment
- Monitoring



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Permitting

- Stakeholders – USACE, US EPA, National Park Service, District of Columbia, Anacostia Watershed Toxics Alliance
- Issues – Sediment/contaminant resuspension, suspended solids from caps, contaminants from cap materials
- Solution – Laboratory data, silt curtains, pre and post-deployment monitoring



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Cap Deployment - Apatite



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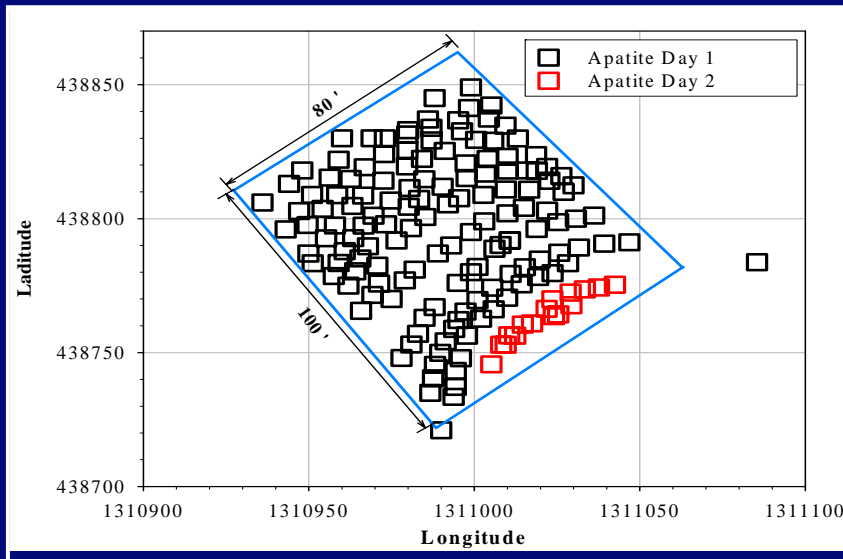
Cap Deployment - Apatite



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Cap Deployment - Apatite



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Bill C. Diehl and
Richard G. Conner



Cap Deployment - Coke



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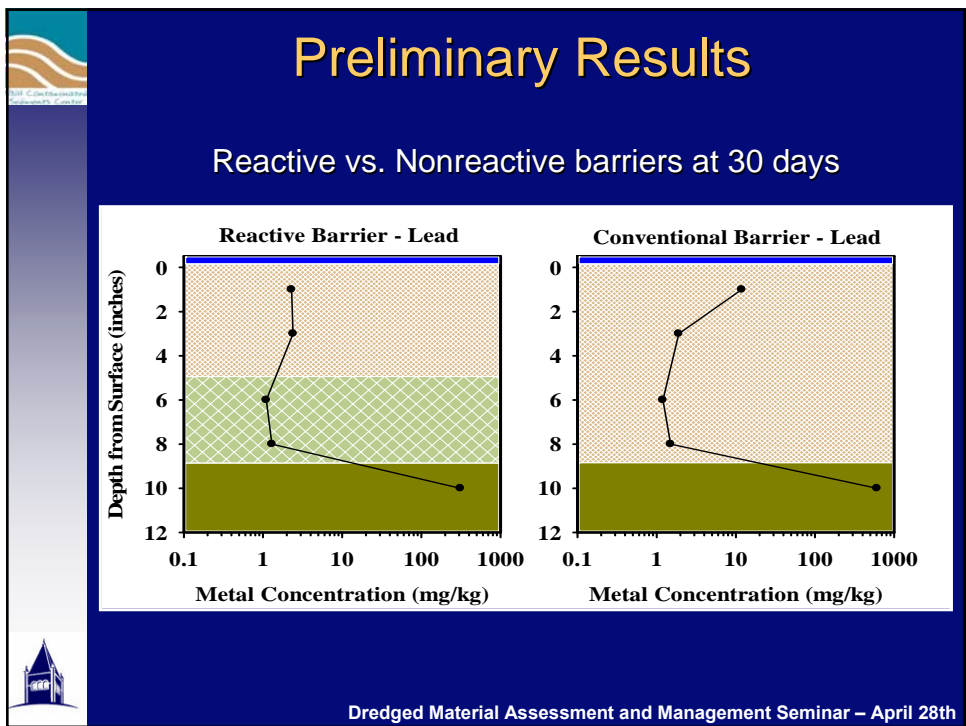
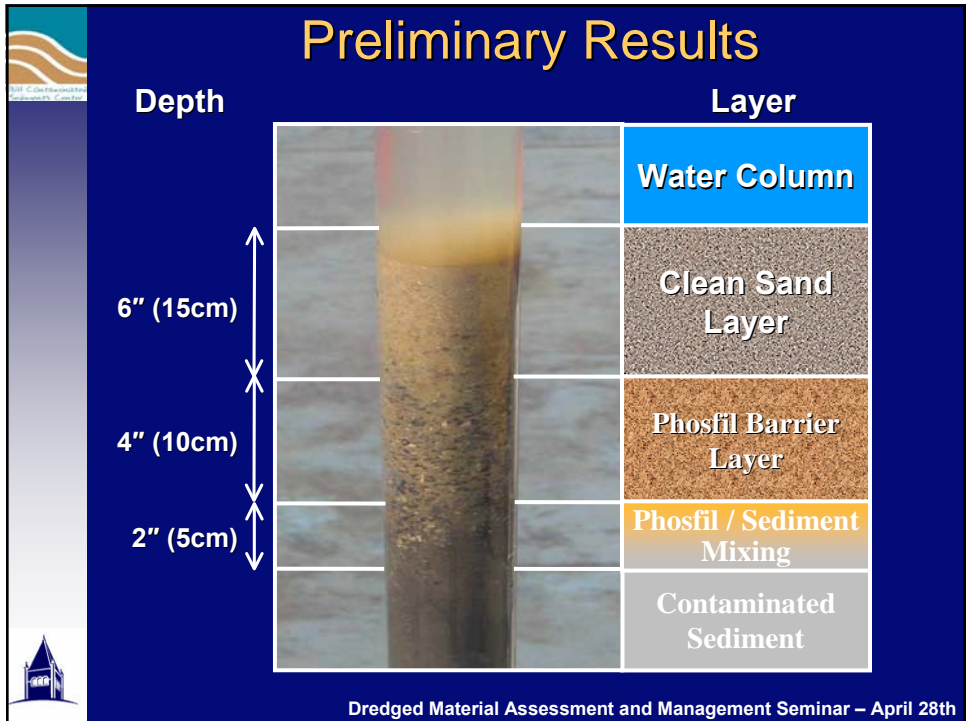
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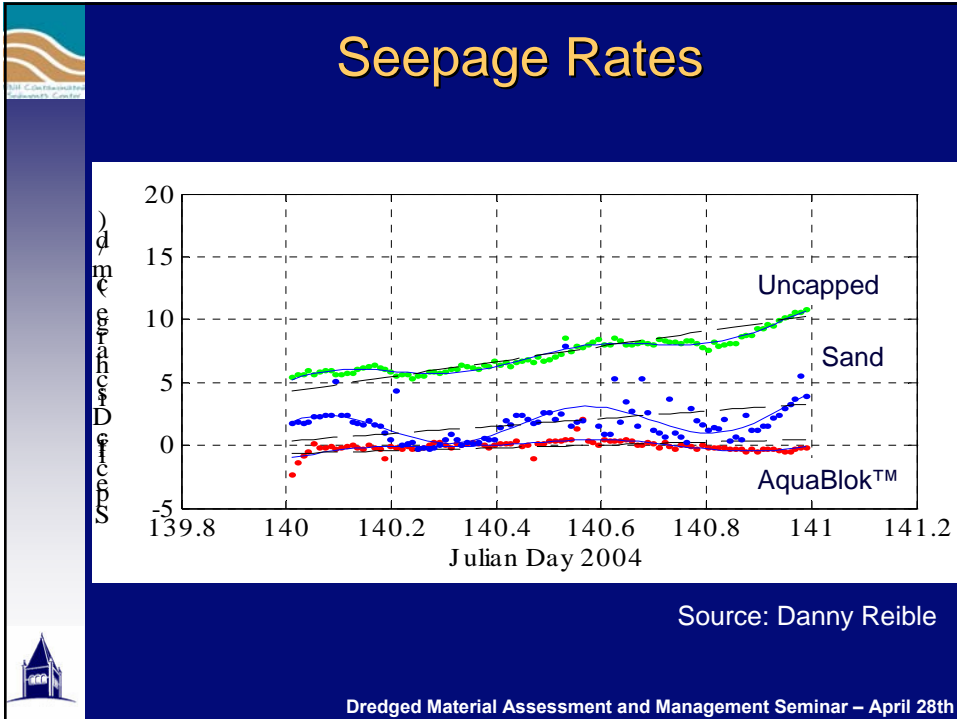


Cap Deployment - Coke



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- ## Placement Rates and Costs
- Sand/Apatite placed 1.4 – 33 sq yd/hr
 - Thickness for cap
 - Apatite 5.2±1.8 in, 6 in goal
 - Sand 4.4±1.6 in, 6 in goal
 - In place cost (excludes shipping) for Apatite (6")
 - \$3.10 / sq ft
 - \$28 / sq ft
- Source: Danny Reible
- Dredged Material Assessment and Management Seminar – April 28th



What are the Real Costs?

Capping Material	Minimum Depth Required (cm)	Material Cost (\$/m3) Delivery Included	Cost for Capping Area (\$/m2)
Reactive (2 layers)			
Apatite Layer	2.5	\$ 135.00	\$ 3.38
Sand Layer	15	\$ 10.00	\$ 1.50
Total			\$ 4.88
Conventional (1 layer)			
Sand Layer	75	\$ 10.00	\$ 7.50



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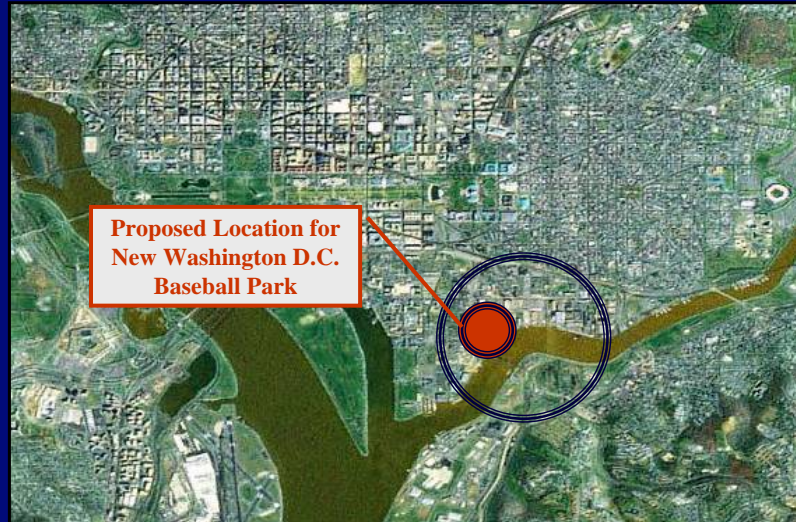
Lessons Learned

- Good site characterization and good stakeholder involvement are crucial to keeping the project on track.
- Granular reactive materials can be deployed by clamshell, but geotextile mats that avoid mixing may be more cost effective for expensive materials.
- Resuspension was not an issue during deployment
- Need to prevent further contamination!



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Future Events on the Anacostia River



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Acknowledgements

- Dr. Danny Reible – U. Texas at Austin
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Questions?



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