In-Situ Capping
Current Issues and Challenges

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In-Situ Management with Capping

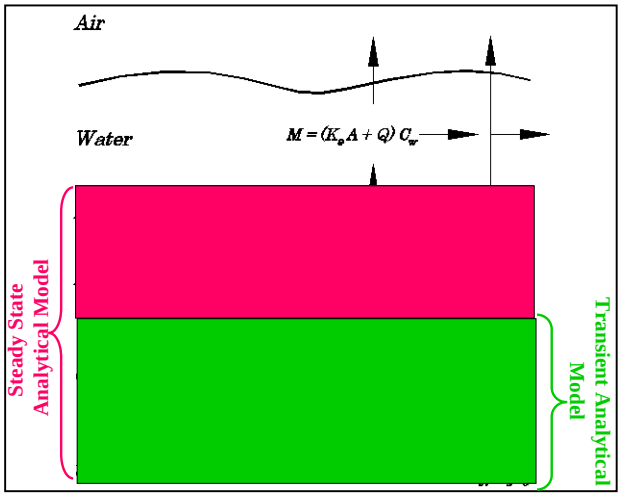
- Sand caps easy to place and effective
  - Contain sediment
  - Retard contaminant migration
  - Physically separate organisms from contamination
- Greater effectiveness possible with “active” caps
  - Encourage fate processes such as sequestration or degradation of contaminants beneath cap
  - Discourage recontamination of cap
  - Encourage degradation to eliminate negative consequences of subsequent cap loss
- Potential for habitat development

Potential amendments to encourage fate processes

- Aquablok
  - Control of seepage and advective contaminant transport
- Phosphate mineral (Apatite)
  - Encourages sorption and reaction of metals
- Coke
  - Encourages sorption-related retardation
- Zero-valent iron
  - Encourages dechlorination and metal reduction
- BionSoil
  - Encourage degradation of organic contaminants
- Organoclay sorbent
  - Encourages sorption-related retardation
- Activated Carbon
  - Encourages sorption-related retardation and sequestration
- XAD-2/Ambersorb
  - Encourages sorption-related retardation and sequestration
- High value materials can be placed in laminated mat
  - used in Anacostia for coke

Cap Modeling and Design

http://capping.hsrc.lsu.edu

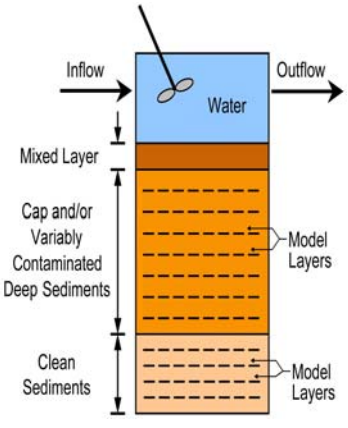


CAP

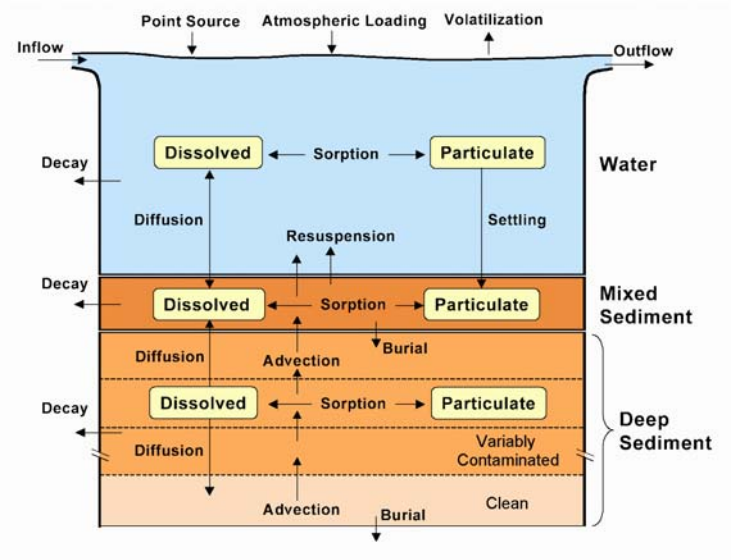
- Extension of the RECOVERY model (USACE contaminated sediment-water interaction model)
- Couples consolidation predictions by the PSDDF model with contaminant transport (PSDDF is USACE dredged material consolidation model)
- Addresses short-term advection and long-term diffusion of contaminants
- Assumes reversible linear equilibrium sorption and first order decay kinetics

RECOVERY

- PC BASED, USER FRIENDLY
- FULLY MIXED WATER BODY AND LAYERED BOTTOM SEDIMENTS
- TIME-VARIABLE
- ORGANIC CONTAMINANTS DATABASE
- COMPUTES SEDIMENT AND WATER CONTAMINANT CONCENTRATIONS AND FLUXES VS TIME



Schematic of CAP Processes

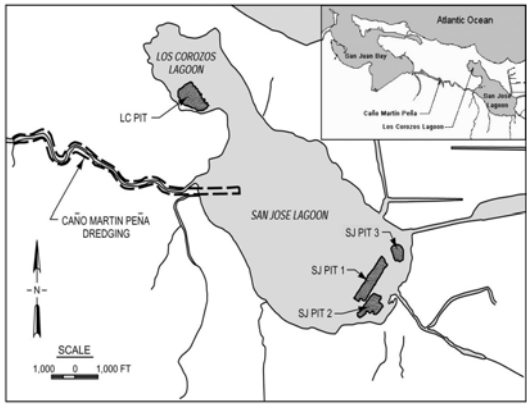


Dredged Material Disposal for San Juan Bay

Martin Peña Canal widening and San Juan Harbor – maintenance

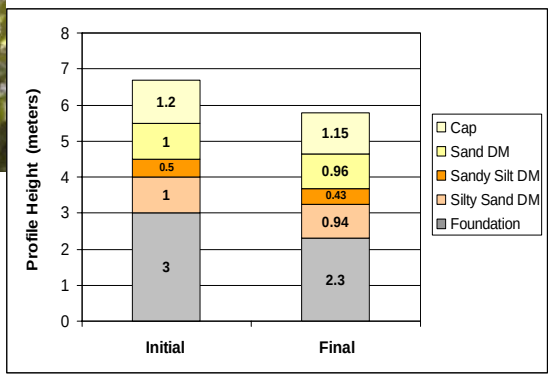
- 750,000 in situ cubic yards
- mechanically dredged 200,000 in situ cubic yards
- hydraulically dredged

- Alternative evaluated
  - Contained Aquatic Disposal



Martín Peña's CAD Evaluation

Conceptual Model

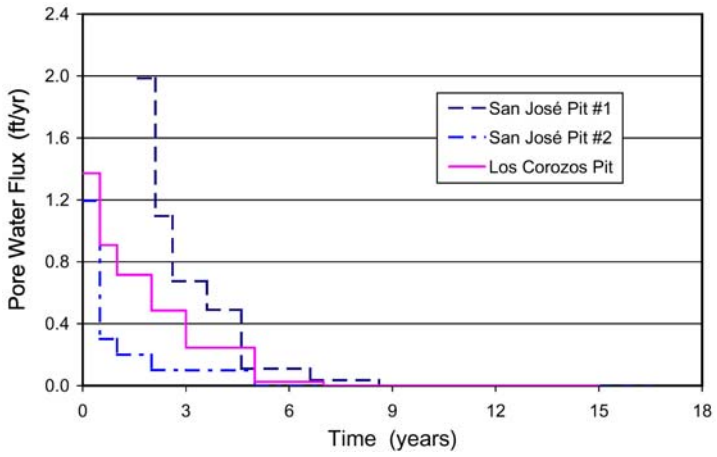


•Selenium was determined to be the contaminant of concern with measured concentration of 149 ppb in the pore water.

•Water quality criteria is 71 ppb.

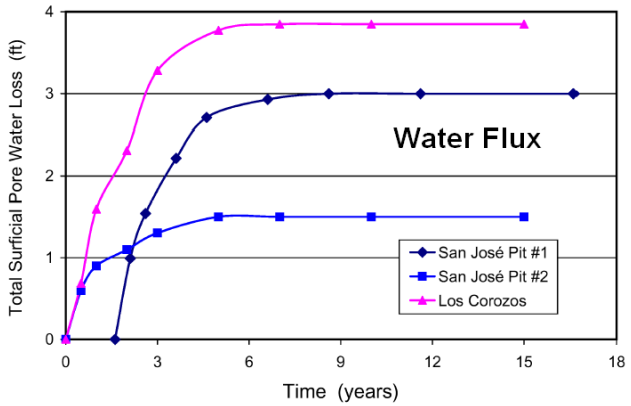
Martín Peña's CAD Evaluation

Advective Flux

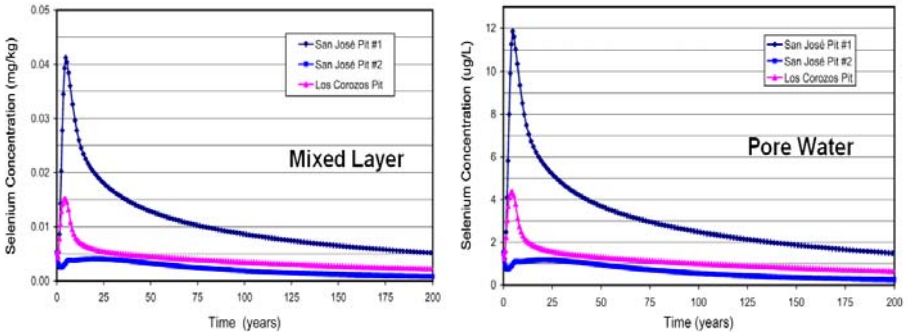


Martín Peña's CAD Evaluation

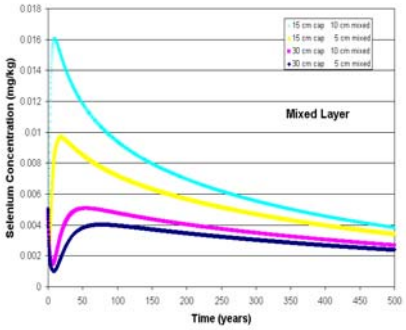
Advective Flux

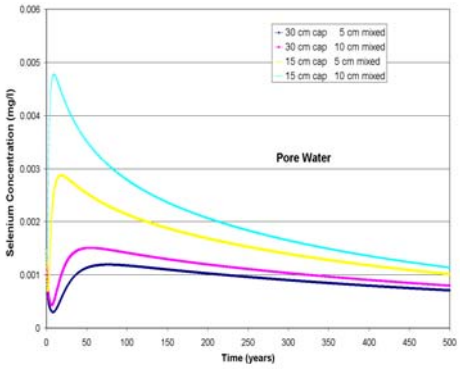


Martín Peña's CAD Evaluation



Martín Peña's CAD Evaluation Thin Cap





Conclusions

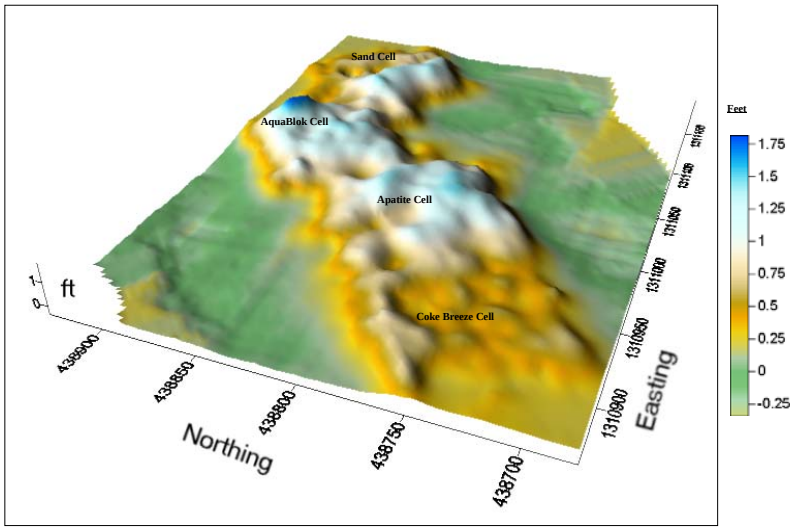
- CAP is an effective tool for CAD evaluations
- The contribution of selenium to the water column is predicted to be less than 1 percent of the water quality standard.
- The maximum concentration of selenium in the mixed layer pore water is predicted to be less than 20 percent of the water quality standard.
- The maximum concentration for selenium for a 15 cm thin cap is 50 percent greater than for a thick cap but much less than the water quality standard.

Capping Issues and Complications

- *Cap performance criteria*
- *Opportunities for active capping*
- **Controlled placement in thin layers**
- Long term containment of contaminants
- Erosion due to wind-driven waves or stream flow
- Ice scour
- Influence of habitat on cap performance
- **Ground water upwelling**
- **Gas ebullition**
- **Mobilization of NAPL**
- Sediment slope stability
- Incorporation of habitat values into cap design

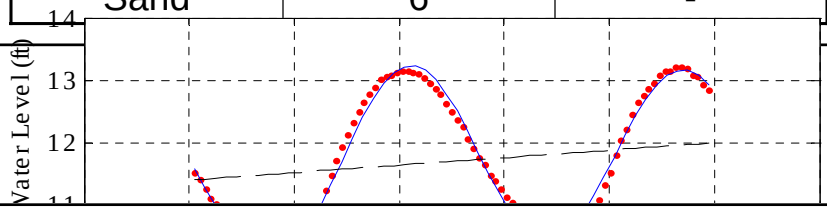
Topics to be discussed in bold
Topics already discussed in italics

Cap Placement in Anacostia

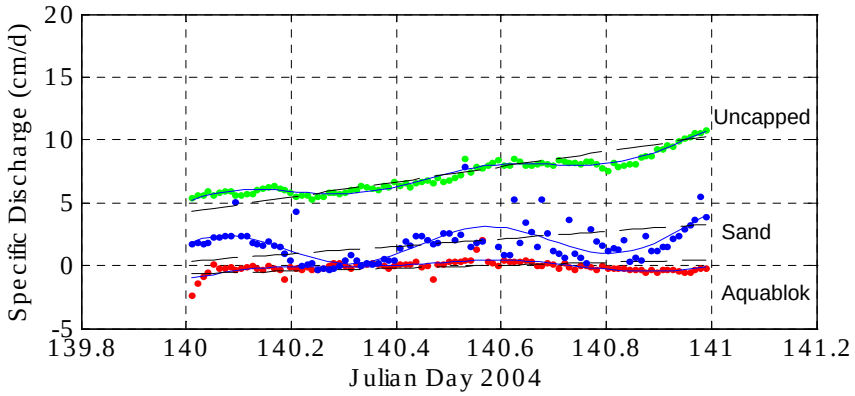


Cap Thicknesses

Cap	Target Thickness -in	Observed in±σ
Sand	12	8.9±3.2
Aquablok	4	4.5±2.0
Sand	6	5.3±1.8
Apatite	6	4.9±1.2
Sand	6	4.5±1.2
Coke	1	1 (mat)
Sand	6	-



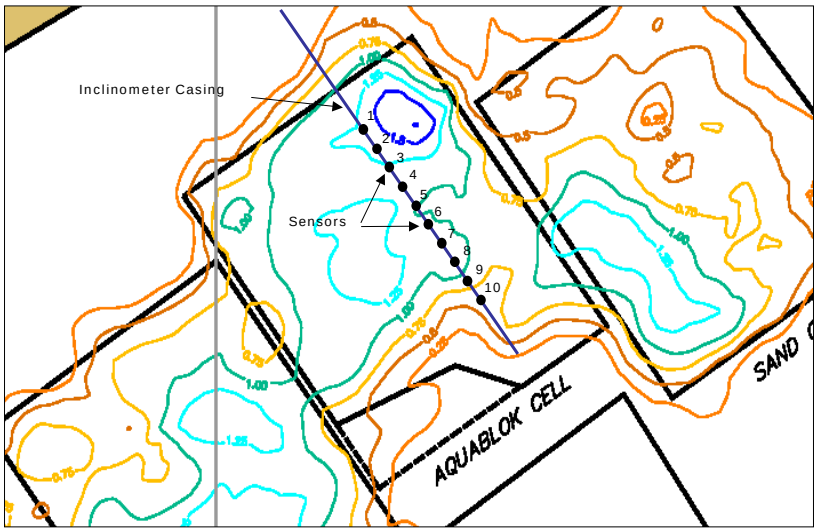
Seepage Rates – Post Placement



Smith, 2004

Gas Release in Anacostia

Effects of Gas on Impermeable Cap – Inclinometer Placement



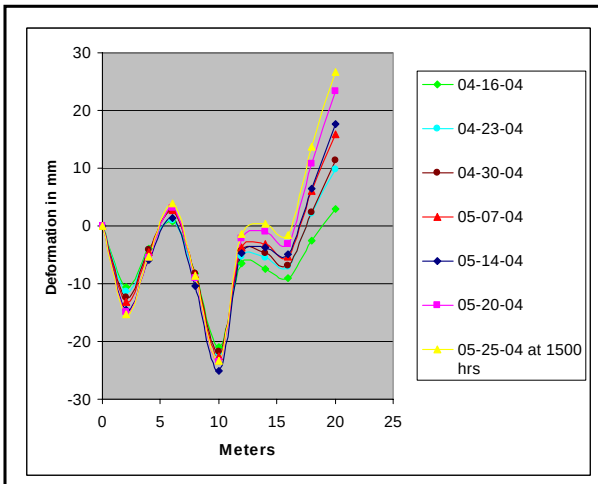
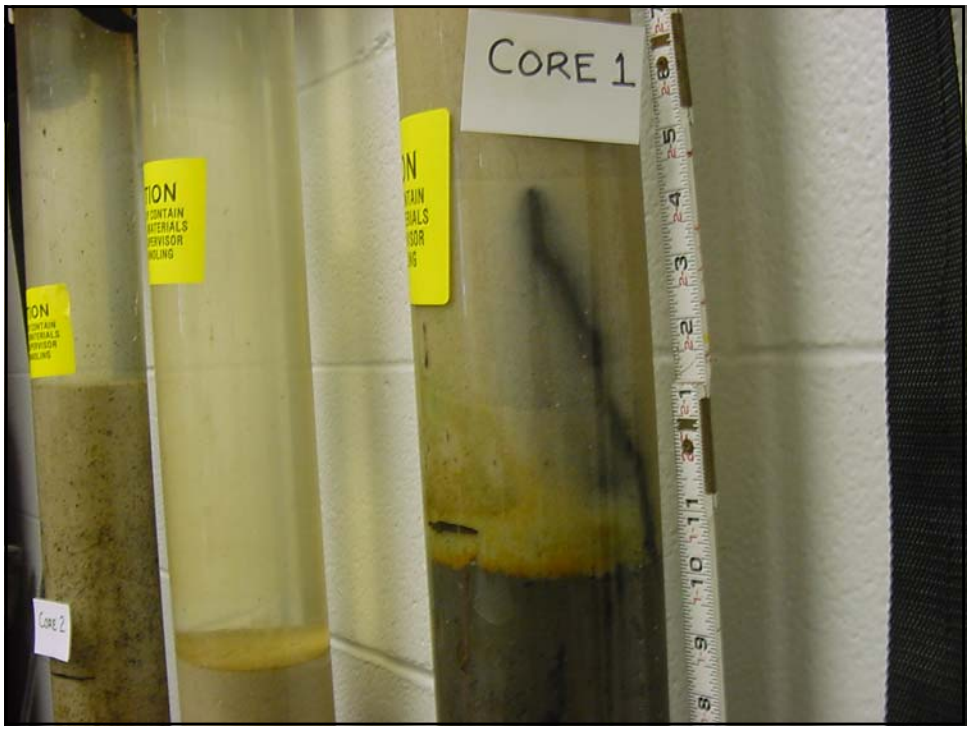


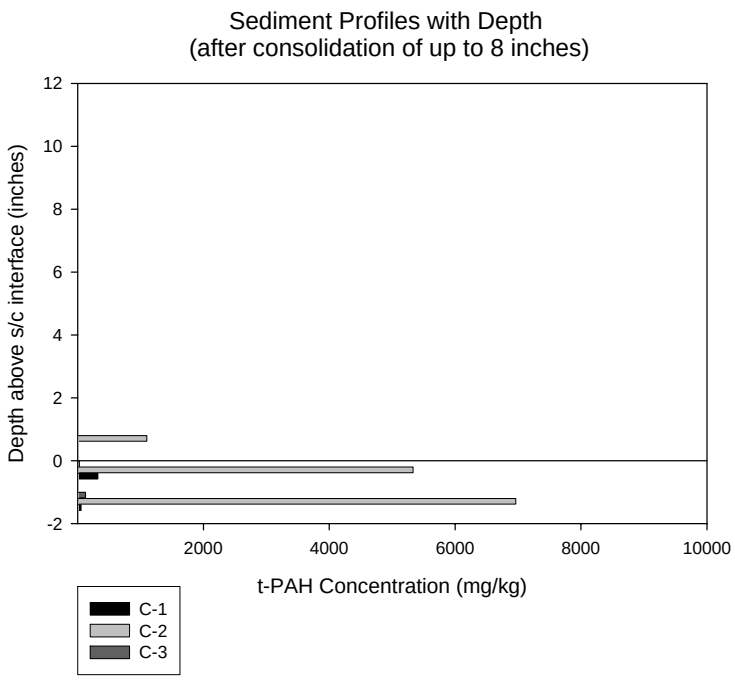
FIGURE 2

Cap Deformation During the Period 4/16/4004 through 5/25/04 1500 hrs

Anacostia River Sediment Capping Research Project
Washington, D.C.

HydroQual, Inc.





Summary

- Sand caps easy to place and generally effective
- Variety of modeling tools available for different applications
- Design for risk reduction – flux and porewater concentrations?
- Placement of sand or active cap materials in thin layers with conventional equipment possible
- Laminated mat provides opportunities for placement of high value reactive material
- Issues to assess on site-specific basis influencing long-term stability, containment and effectiveness
  - Slopes
  - Ice
  - Gas
  - NAPL