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Past and Future Trends in Environmental Dredging Projects

Presented by
Ram K. Mohan, P.E., Ph.D.
Anchor Environmental, LLC

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Navigational Dredging

- Depth-based removal
- Less stringent controls
- Large volumes
- High production rates
- “Low” cost disposal
- Low cost

Environmental Dredging

- Concentration-based removal
- Higher environmental control
- Smaller volumes
- Low production rates
- More restricted disposal
- High cost

Sediment Risk Evaluation

Comparison of risk under current conditions versus conditions during, and after dredging (short and long term effects)

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Dredging Effectiveness

Define realistic goals at project inception; Follow up and ask "were the goals accomplished?"

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During-Dredging Releases

- Dredging releases may be unavoidable
- Dredge resuspension models give an estimate
- Contaminant release not proportional to sediment release
- Lessons from past projects indicate that ~1-4% of dredged COCs could be released, mainly in dissolved form

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Effectiveness Parameters

- Resuspension
- Residuals
- Sediment stability
- Risk-based parameters
  - Fish, sediment, water column, air, habitat quality
- Schedule
- Cost/budget
- Community concerns

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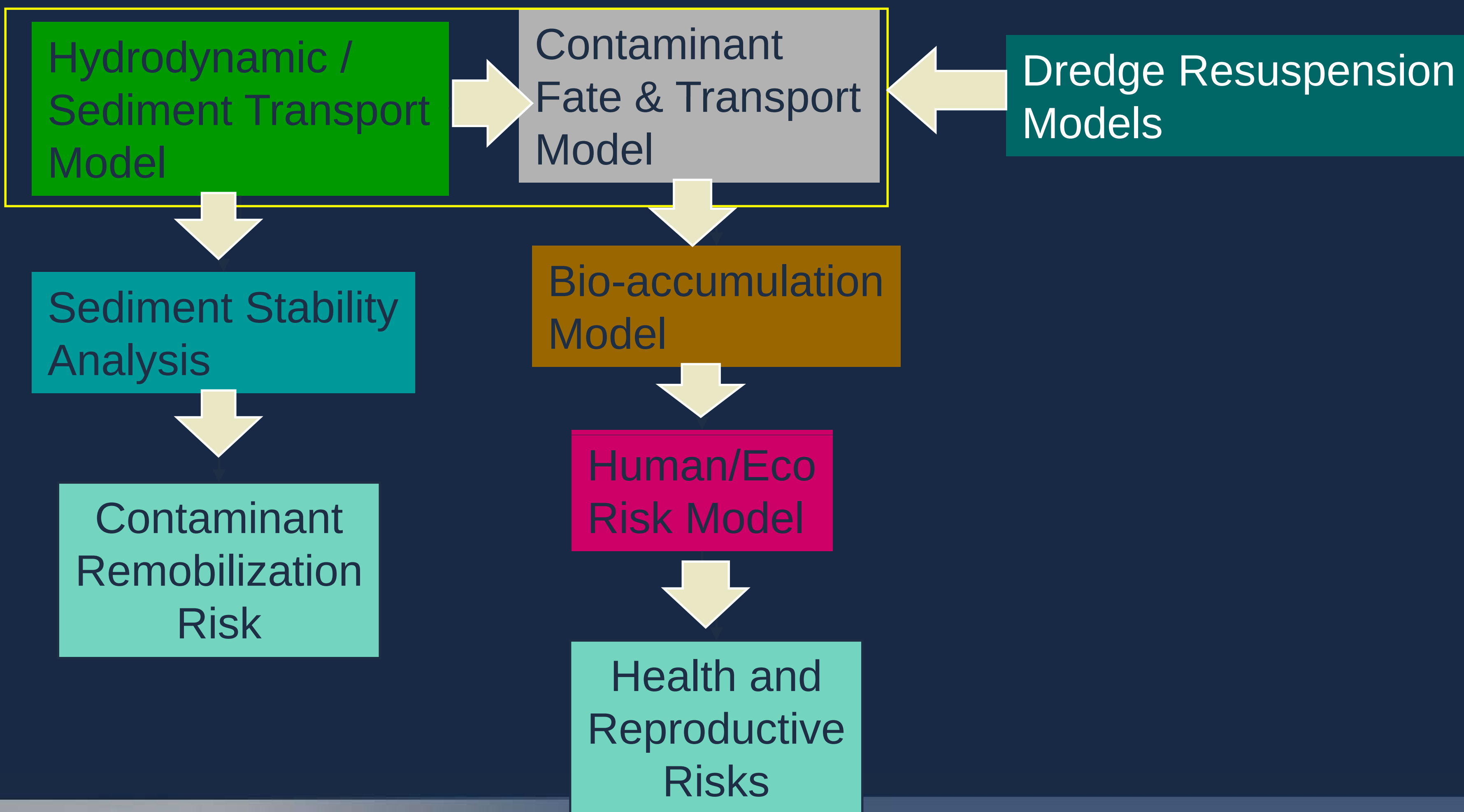
Numerical Simulation

What is the risk prior to, and following dredging?
How does dredging effectiveness affect this analysis?

Typical Model Framework



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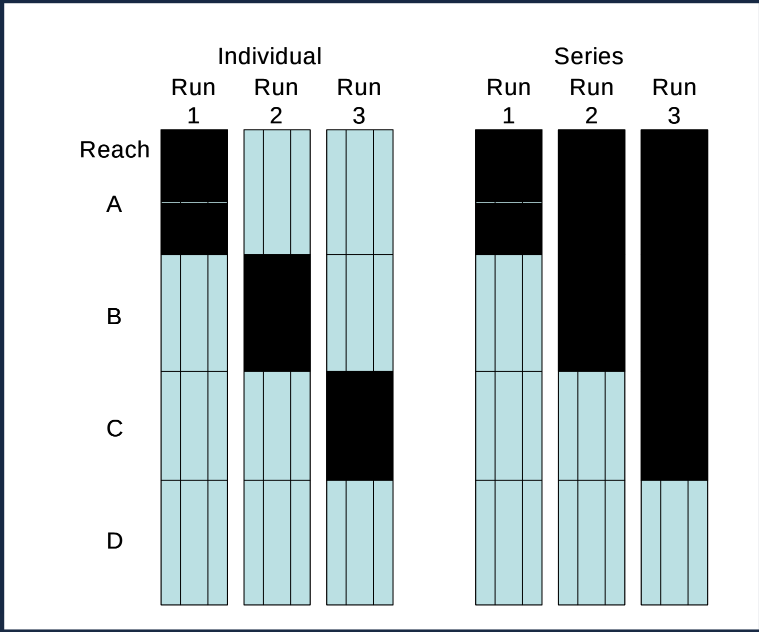
Model Process

- Development of baseline model
- Screening level modeling of dredging alternatives
- Detailed dredging forecasts
- Compare results
  - (risk/transport/permanence)
- Uncertainty analysis



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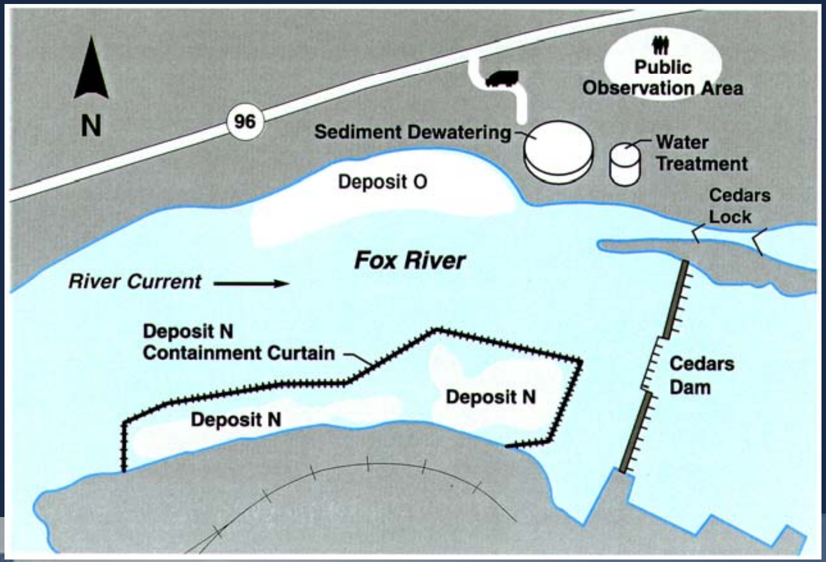
Select Case Studies

Fox River, WI – Deposit N Pilot

- Goal→ Remove majority of contaminated sediment and leave thin residual layer (65% of volume targeted for removal due to bedrock conditions)
- 8,200 cy removed from November to December 1998 and August to November 1999 (WDNR) (1,000 cy removed from Deposit O)
- Removed via hydraulic dredging (cutterhead)



- Silt containment included a perimeter turbidity barrier (80 mil HDPE) and two deflection barriers
- Sediment dewatered and disposed off site
- Project cost = $4.3M (~$525/cy)

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Private Pond – Wisconsin

- Goal → Close to 100% removal of soft sediment (7,730 cy)
- 1000 ft section of creek temporarily drained in 1994
- Pre-removal surface sediment PCBs =ND - 2,500 ppm (average=56 ppm)
- Residual sediment exhibited 9.2 - 300 ppm PCBs (average = 76 ppm)
- Project cost = $7.5M (~$970/cy)

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Confidential River, New York

- Mech. removal of debris, boulders/cobbles
- Hydraulic dredging of 14,000 cy of PCB sediment
- Onsite dredge water treatment
- Post-dredge clean up goal 1 ppm PCBs
- Resuspension limit – 25 NTU above background
- Completed in 1 dredging season
- Challenges
  - –Controlling release of suspended dredge sediment; switched from perimeter silt curtains to sheet pile
- Project Costs
  - –$7.5 million (does not include off site disposal)
  - –~$500-$600/cy

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Lake Järnsjön, Sweden

- 62-acre lake in Sweden located on the Emån River.
- Goal → 0.5 ppm PCBs
- Hydraulic dredging
- Lake bottom was dredged to depths of 1.3 - 5.3 feet (196,000 cy)
- Sediment dewatered and disposed locally (upland adjacent to lake)

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Private Lake, Michigan

- Hydraulic/Mech. removal of 5,400 cy of perimeter sediment and backfilling
- Onsite dredge water treatment
- Onsite dewatering using shaker screen, hydro cyclones and recessed chamber filter presses
- Sediment stabilization with quick lime pellets
- Offsite disposal of dewatered sediments
- Post-dredge visual verification for removal of black soft sediments
- Clean up sampling for Lead
- Project Costs
  - $2.9 million (does not include off site disposal)
  - ~$500-$600/cy

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Thunder Bay, Ontario, Canada

- Dredging of 11,000 m3 containing PAHs, CP and D&F
  - Post-dredge clean up goal – 30 ppm total PAHs
  - Resuspension control limits – 25 NTUs above background
- Off site Thermal Treatment
  - Treatment Criteria PAHs (260 ppm), CP (5ppm), D&F (1 ng/g TEQ)
- Waterloo Barrier® Sheet Pile Wall
- Onsite dredge water and groundwater treatment
- Creation of 15 hectares of land and 5 hectares of fish and wildlife habitat
- Total project duration – 7 years
- Project Costs
  - $20 million CND
  - ~$1,500-$2,000 (CAN)/m3

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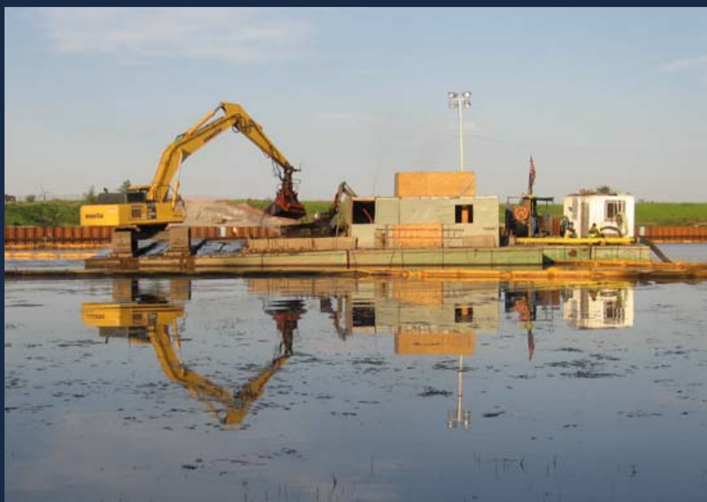
St. Louis River, Minnesota



- 190,000 cy dredging of sediments containing PAHs
- Onsite dredge water treatment
- Onsite Disposal in a slip converted to a wetland
- Post-dredge clean up goal – 13.7 ppm total PAHs
- Resuspension control limits – 25 NTUs above background
- Backfill – 6” sand, 6” organic sediment
- Total project duration – 4 years
- Project Costs
  - $32M total
    - [$10M for dredging/disposal/water treatment]
  - ~$50-$200/cy

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Los Angeles Pilot CAD Cell, CA

- 105,000 m3 mechanically dredged sediment containing metals, PAHs and pesticides
- Bottom dump scow placement into existing depression in Long Beach inner harbor
- Capped with 3 foot layer of medium grained sand
- Completed in approximately 8 months (including 4 month settling period prior to capping)
- Water quality monitoring conducted at point of dredging/disposal, for 5 years
- Project Costs
  - Approximately $2.7M for total project
    - [Approx. $1.1M for dredging portion]
  - ~$10-$25/cy

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Environmental Dredging Projects - Observations

- Can effectively remove mass
- Useful in areas where high concentrations exist in relatively unstable sediments
- Limited ability to consistently reduce surface concentrations to low levels
- Cost effective, if:
  - reasonable controls are set
  - Disposal is local or inexpensive
- May introduce new problems
  - short-term health and safety risks
  - habitat destruction
  - disruption to other uses of waterway

Common Pitfalls

- Inadequate site characterization
- “Poor” engineering design and contract drawings
- Contractor issues
  - “Dredging” contractor without “environmental” background
  - “Environmental” contractor without “dredging” background
- Unrealistic project goals
  - Low post-dredged surficial concentrations
  - High restrictions on resuspension
- Limited monitoring during and after dredging to demonstrate effectiveness

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Future Trends?

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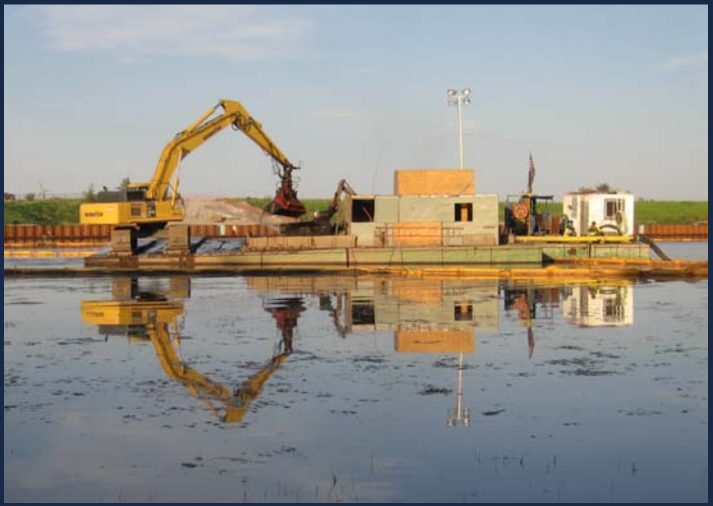
Future Trends……….

- Cleanup goals should be determined based on collaboration between all parties
  - Should site-specific basis
- Project schedules should be driven by project expectations, dredging technologies and seasonal constraints
- Recently, "Performance standards" are applied
  - Engineering & Quality of Life standards
  - Should be developed "in-balance", based on collaboration
- Hybrid Remedies?



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Future Trends?

Better engineered projects

Contractors getting more savvy

Higher expectations from projects

Construction disputes?

Questions?

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