Sediment and Site Characterization for Environmental Dredging
(Tab C)

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Training Objectives

• Identify site characterization components needed for dredging design.
• Identify sediment characterization needs specific to dredging.
• Identify sediment characterization tools and methods.
Removal Issues

- Accuracy and Precision
  - horizontal and vertical
- Sediment Resuspension
  - sediment transport and contaminant release
- Residual Sediment
- Production/ Efficiency of Removal
  - debris removal
  - rate of removal
- Interface with transport, treatment and placement
  - solids concentration

Need for Characterization

- Inadequate site and sediment characterization is one of the major causes for problems associated with use of dredging as a remedial alternative
- Contributes to
  - Delays and low removal rates
  - Low solids production
  - High treatment/dewatering costs
  - Unacceptable resuspension
  - Unacceptable residuals; inaccurate or imprecise removals
  - Failure to meet CULs, RAOs
- Critical for equipment selection, alternative design, resuspension controls and residuals controls
Site Characterization

- Identify and quantify the contaminants present
- Understand vertical and horizontal distribution of contaminants
- Identify sources
- Understand geomorphological setting and processes affecting the stability of sediment
- Understand key processes affecting the fate, transport, and bioavailability
- Identify the complete exposure pathways
- Identify human and ecological risks posed by the contaminants (air)
- Collect data necessary to evaluate the potential effectiveness of remedial alternatives, and
- Provide a baseline of data that can be used to monitor remedy effectiveness

Environmental Dredging

- Navigation dredging principles generally applicable
- Differences
  - Resuspension must be controlled
  - Precision removal required
  - Special purpose dredges available for special project, site and sediment conditions
  - Additional controls available
Typical Characterization

• Physical
  – Geometry/bathymetry of water body
  – Turbidity
  – Temperature
  – Sediment resuspension and deposition rates
  – Depth of mixing layer/degree and depth of bioturbation
  – Geophysical survey results
  – Flood frequencies, annual and event-driven hydrographs and current velocities
  – Tidal regime
  – Surface water/ground water interaction
  – Ground water flow regime

Typical Characterization

• Chemical
  – Near-surface contaminant concentrations in sediment
  – Contaminant profiles in sediment cores
  – Contaminant concentrations in biota tissue
  – Contaminant concentrations in ground water
  – Total organic carbon (TOC) in sediment
  – Contaminant concentrations in surface water
  – Simultaneously extracted metals (SEM) in sediment
  – Acid volatile sulfide (AVS) in sediment
  – Other chemical species that may affect contaminant mobility
  – Oxidation-reduction and pH profile of sediment cores
  – Carbon/nitrogen/phosphorus ratio
  – Non-ionized ammonia concentration in sediment
Typical Characterization

• **Biological**
  - Sediment toxicity
  - Extent of recreational/commercial harvesting of fish/shellfish for human consumption
  - Extent of predators dependent on aquatic food chain (e.g., mink, otter, kingfisher, heron)
  - Abundance/diversity of benthic species and fishes
  - Abundance/diversity of emergent and submerged vegetation
  - Habitat stressor analyses
  - Contaminant bioavailability
  - Pathological condition, such as presence of tumors in fish
  - Presence of indicator species

Site Characterization for Dredging

• Buried debris (wood, concrete, scrap, cables…)
• Boulders, rock, hard pan or “refusal” (overdredge)
• Dredging depth and side slopes
• Slope stability
• Currents (seasonal, tidal)
• Access and navigation demands
• Staging area and disposal area
• Transport routes for dredged material
Resuspension Concerns – More than Contaminants

Physiological effects on aquatic organisms?

Acute or chronic turbidity?

Sedimentation on spawning habitat?

SAV & seagrass bed effects?

Delayed fish migration?

Sediment Characterization

• Solids/moisture content and variability
• Atterberg limits
• Specific gravity
• Grain-size distribution and variability
• Organic content, oily phase and volatiles
• Shear strength and/or bearing strength
• Erosional characteristics (Sedflume)
• Dewatering characteristics (settling, filtering, consolidation, permeability …)
Sediment Characterization

- Cores
- Probing
- Geophysical techniques
- Side scan sonar
- Magnetometers

QUESTIONS?