Implemented controls should be commensurate with potential risk...
Open Water Placement
Risk Management Considerations

- Material Suitability
- Site Characterization
- Site Designation/ Selection
- Operational Considerations
- Design Evaluations
- Control Measures/ Management Actions
- Site Management Plan
- Monitoring
Material Suitability

• Is proposed dredged material suitable for open water placement at the site without special management or controls?

  ➢ Physical impacts
    – MPRSA sites via site designation
    – CWA sites project specific

  ➢ Contaminant impacts
    – MPRSA via OTM procedures
    – CWA via ITM procedures
Site Characterization

- Bathymetry
- Water depth/stratification
- Current/wave conditions
- On-site biological resources
- Proximity to sensitive resources
Site Designation/ Selection

- **Ocean Site Designation (MPRSA)**
  - Formal Designation Process
  - EPA Designated General Use (Section 102)
  - USACE Designated Specific Projects (Section 103)
  - Final and Interim Designations

- **Site Selection in US Waters (CWA)**
Operational Considerations

- Equipment and placement techniques
- Time, rate, location, and methods of placement
- Quantity and frequency of materials placed
- Navigation and positioning
- Site controls, e.g. Buoys
- Coordinating site use among permit holders
- Monitoring
Placement Methods

Hopper, NY Mud Dump

Submerged Diffuser

Denny Way CSO

One Tree Island Marina

Tools to Evaluate Effectiveness

• Water Column Dispersion
  - STFATE or CDFATE or others

• Placement technique, location, and rate
  - Mound Development ~ MDFATE / MPFATE

• Long-Term Stability and Site Capacity
  - Consolidation ~ PSDDF
  - Erosion/ Consolidation ~ LTFATE

• Far Field Transport ~ TABS, ICM, PTM
STFATE

1. Convective Descent and Collapse (High-Density Material)
2. Consolidation of Mound
3. Dispersion (Very Low-Density Material)
4. Dispersion (Impact Cloud)
5. Bottom Transport (Density Flow)
6. Current
Site 69b, TSS
Open Water Control Measures

• Water Column Management
  - Submerged discharge
  - Silt Curtains
  - Geocontainers
  - Treatment (polymer addition)
  - Reduce discharge rate
  - Promote mixing (dump while under tow)

• Benthic Management
  - Treatment (not typically done)
  - Lateral confinement or CAD
  - Capping with cleaner dredged material or armor
  - Geocontainers
Operational Modifications

- Select different equipment type
- Select different equipment size
- Control placement operation
  - Location
  - Rate
  - Method
STFATE Evaluation of Alternatives
3000 CY Barge – Single Dump

Peak Lead Concentrations

Violation of WQS outside the mixing zone

WQS = 0.032 mg/L

Max Conc on Grid
Max Conc Outside M.Z.
M.Z. Standard
STFATE Evaluation of Alternatives
1500 CY Barge – Single Dump

Peak Lead Concentrations

No violation of WQS outside the mixing zone

WQS = 0.032 mg/L

Max Conc on Grid
Max Conc Outside M.Z.
M.Z. Standard
Peak Lead Concentrations

No violation of WQS outside the mixing zone

WQS = 0.032 mg/L

Conc – mg/l

Max Conc on Grid  Max Conc Outside M.Z.  M.Z. Standard

Time (Min)
Submerged Discharge

- Can reduce water column dispersion
- Can improve accuracy of placement
- Pipeline configurations
- Diffuser design available
- Tremie technology

Submerged Diffuser

Barge with Tremie
Silt Curtains

- **Purpose**
  - To control SS/turbidity in the water column (mainly at dredging site)

- **Advantages**
  - Can be used to protect sensitive environments
  - Can allow particles to settle out of the upper water column
  - Commercially available

- **Limitations**
  - Strong currents
    - (> 1 knot/1.5 fps)
  - High winds
  - Debris/Ice
  - Excessive wave heights
  - Fluctuating water levels
  - Must allow traffic in/out
    - Bubble curtains

Silt Curtains

White or Yellow Float Collar

Web Straps

Monofilament or Impermeable Vinyl Curtain

Brass Grommets

Optional 5/16" Chain curtain ballast

Float

Silt Curtain

PIPELINE

TURBID WATER

FLOCCULATED MATERIAL

SILT CURTAIN

FLUID MUD

BOTTOM SEDIMENT

CURRENT

EFFECTIVE DRAFT DEPTH
Geo-containers

- Geotextiles used for solids containment
- Can reduce water column dispersion
- Can reduce capping requirements
- Engineering design approaches available
- Operational aspects need refinement
CAD/Capping

Purpose - Manage risks from contaminated material by:

- Physical isolation of contaminants
- Reduction of contaminant flux
- Physical stabilization
  - Limiting losses during placement
  - Reducing mobilization and erosion
CAD Approaches

- Existing Pits/Fills or Excavated Pits – (most stable)
- Lateral Confinement

**Confined Aquatic Disposal**

- Mounds
- In Situ Capping

**Level Bottom Capping (LBC)**

Dredged Material Assessment and Management Seminar
15-17 September 2009, Detroit, MI
Capping Considerations

- Placement and design of constructed cells
- Placement techniques for unsuitable material
  - Controlled, accurate
- Placement techniques for cap material
  - Even coverage
  - Avoid displacing unsuitable material
- Cap design – account for:
  - Erosion
  - Bioturbation
  - Recolonization
  - Consolidation
  - Contaminant transport
  - Operational factors
Cap Designs

Minimal Isolation Capping

Isolation Capping

Bioturbation

Biodiffusion

Contaminated Sediment

Chemical Isolation

Contaminated Sediment
Cap Design Specifications

- Cap thickness designed to prevent breach from:
  - Props
  - Anchors
  - Fishing trawlers/nets
  - Storm waves
  - Flood currents

- Materials
  - Erosion control – armor, cohesive
  - Contaminant control
  - Habitat

Example Cap Design

12" GRADED ARMOR STONE
GEOTEXTILE FABRIC
20" SAND MATERIAL
SEDIMENT
BEDROCK
Capping Materials

• Granular Materials
  - Sediments
  - Soils
  - Quarry run materials

• Fabrics, Membranes and Specialty Materials

• Armor Stone

• Amendments
  - Adsorbents
  - Reactants
Cap Processes

- **Physical**
  - Erosion and armoring
  - Deposition
  - Consolidation
  - Mixing and disruption

- **Chemical**
  - Diffusion
  - Advection/Convection
  - Biotic Degradation
  - Abiotic Degradation
  - Adsorption/Retardation
  - Volatilization/Stripping by Gas Transport

- **Biological**
  - Recolonization
  - Bioturbation

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Dredged Material Assessment and Management Seminar  
15-17 September 2009, Detroit, MI
Recovery/Cap Model

- Long term effectiveness evaluations
Cap Placement Methods

- Baffle Plate on MS River
- Spray ed slurry system placing sand at Soda Lake, WY
- Simpson-Kraft Sand Box
- Sand Spreader Barge
- Eagle Harbor
Capping Guidance

• **USACE guidance for DM capping**

• **EPA (ARCS) guidance for ISC**
  - [http://www.epa.gov/hlnpo/sediment/iscmain/index.html](http://www.epa.gov/hlnpo/sediment/iscmain/index.html)
Site Management Plans

- Roles and responsibilities
- Management objectives
- Specifics on operations and management
- Inspection and enforcement
- Monitoring requirements
LA-3 Ocean Dredge Material Disposal Site

Estimated barge location at initial dump point: offset from tug by 250 feet at 25 degrees azimuth

Note: The coordinates for trips #667, and #1116 are outside of the map extent.
Open Water Site Monitoring

- **Need for Monitoring**
  - Evaluate effectiveness of management
  - Evaluate environmental impacts
  - Recommend modifications

- **Monitoring Plan**
  - Clear objectives
  - Testable hypotheses
  - Methods and equipment

- **Management Actions**

- **Silent Inspector**
  - Location
  - Volume
Maintenance and Rehabilitation

- Assess findings to establish needs by comparing with performance predictions, considering natural processes
  - If in agreement or better, adapt monitoring plan to findings
  - If contradicts predictions, determine processes of interest
  - Perform process-based confirmation monitoring
  - Determine maintenance and rehabilitation needs

- Maintenance: Restores performance in response to extreme events

- Rehabilitation: Upgrades performance to achieve long-term performance goals
Open Water Monitoring Tools
Summary

- Site selection / characterization
- Material suitability
- Planning the disposal operation
  - Models available
- Site controls
- Site management plan
- Monitoring
Questions??