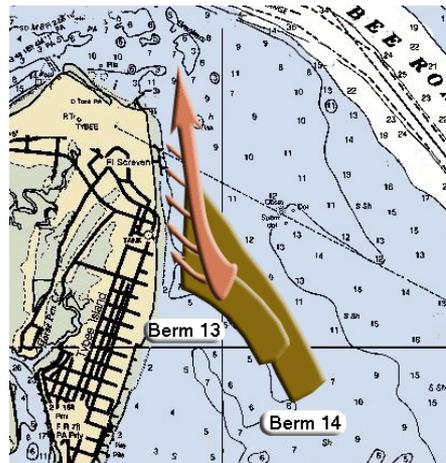
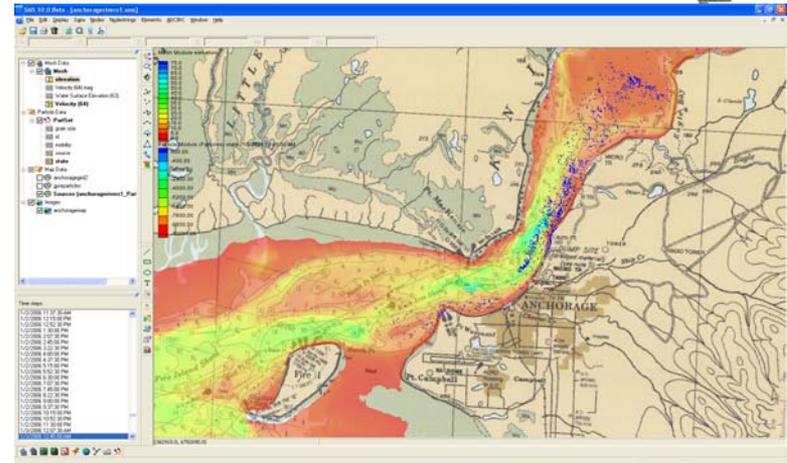
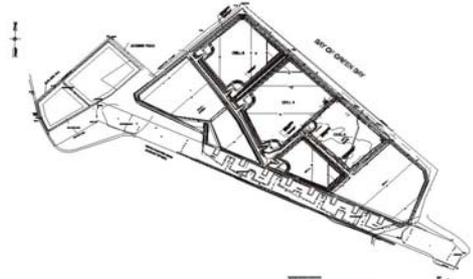
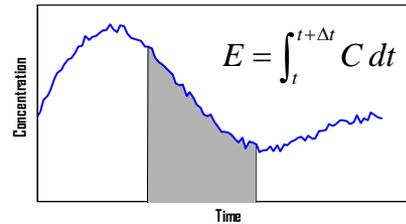


# DOER Dredged Material Management (DMM) Focus Area

Joseph Gailani

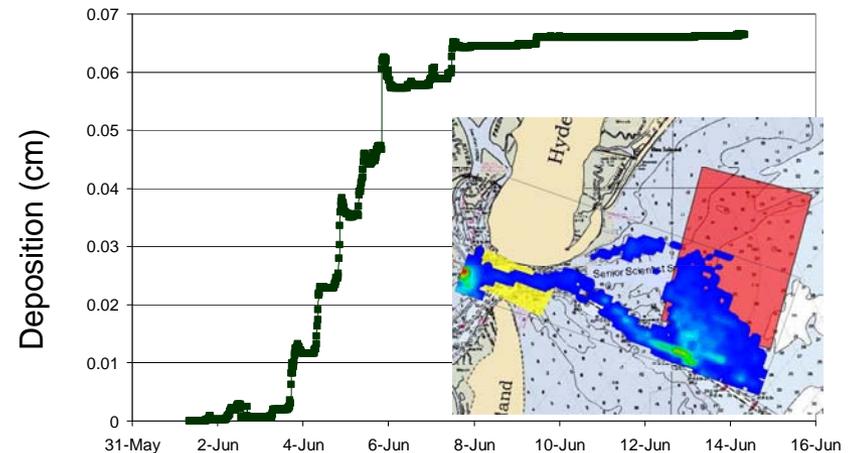


# DMM Focus Area Objective

- **Situation**: Districts must address increasingly complex issues related to DM and CDF management
- **Barriers**: Existing knowledge of DM processes during dredging operations and after placement are not sufficient to define relevant processes. Existing capabilities for assessing DM and CDF management cannot address these complex issues
- **Solution**: Improve our understanding of processes relevant to dredged material fate and management. Develop appropriate suite of tools (models, databases, and data management systems) to address current and future DM and CDF issues. Interconnect these tools to expedite analysis.

# DMM Focus Area Work Units

1. Dredging, Placement, and Dredged Material (DM) Processes
  - Dredged Sediment Processes
  - Dredging and Placement Processes/Controls
2. Dredging Models
  - Dredging and Placement Models
  - Dredging Project Data and Model Management
3. Regional and Lifecycle Management of CDFs
  - CDF Operations and Management
  - CDF Reclamation



# DMM Products

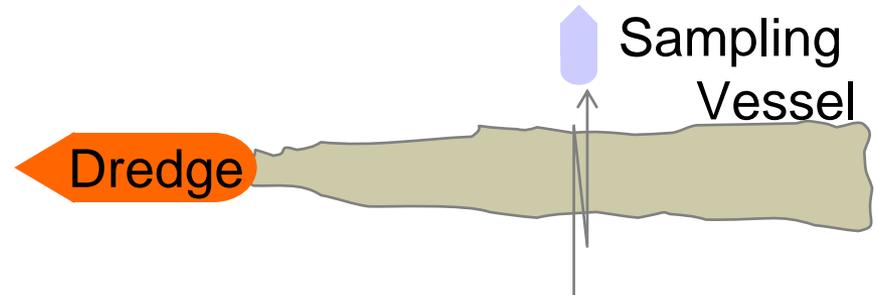
## Dredging Source Terms

- **Problem/Purpose**

- Environmental effects related to suspended sediment released during dredging
- Temporal, spatial, site, and dredge-type specific factors affect releases
- Require capabilities to predict and monitor releases

- **Solution/Approach**

- Field measurements of dredging releases
- Correlate to Silent Inspector operational data
- Develop algorithm for hopper dredge releases
- Validate with plume monitoring



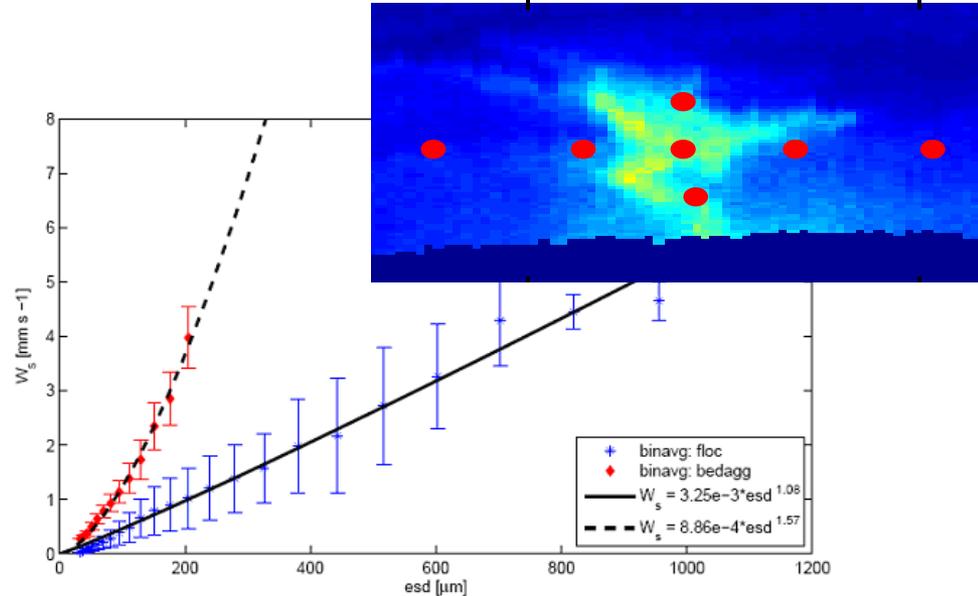
- **Products**

- Algorithms for hopper and bucket dredge releases
- Overflow releases
- TR and JPs: Dredged material sources

# DMM Products

## Dredging Plume Evolution and Decay

- Problem/Purpose
  - Sediment characteristics in dredge plume poorly understood
  - Highly conservative assumptions related to settling increase costs of dredging operations.



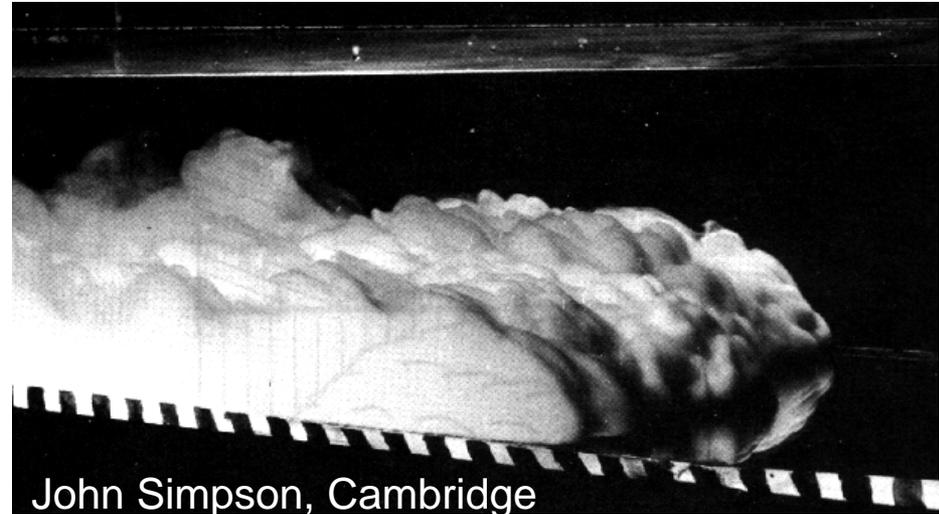
- Solution/Approach
  - Characterize cohesive sediment aggregate states and settling velocities through field measurements.
  - Transfer research findings to FATE models.

- Products
  - Field-deployable instrumentation system
  - Settling velocities and aggregate states in dredge plumes
  - Findings currently implemented in SF Bay

# DMM Products

## Dredged Material Underflow Processes

- Problem/Purpose
  - Present predictive capability for dredged material spread (underflow) is modest
  - Develop process understanding and models needed to address BU and regulatory issues
- Solution/Approach
  - Improve understanding of descent, collapse and underflow
  - Characterize sediment processes in underflow.
  - Develop 2-Phase flow models for underflow



- Products
  - Databases and guidance documents on DM spread
  - Numerical underflow model for continuous discharge
  - Model for discrete discharge

# DMM Products

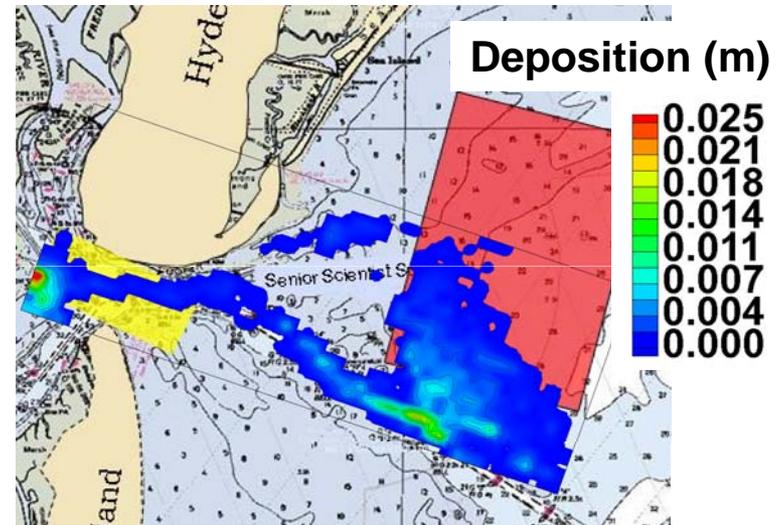
## Open Water Dredging Models

- Problem/Purpose

- Dredging models do not address present regulatory and BU issues
- Code and process descriptions are outdated in many models
- Update, replace, and add dredging models to address present and future issues

- Solution/Approach

- Develop suite of new models/tools:
  - Improved process understanding
  - Efficient computational methods
  - GIS and other databases
  - Available hydro and wave models
  - Nearshore processes for BU
- Address in-water BU issues



- Products

- C3SHORE
- MODIFIED MPFATE
- New Underflow Model
- Replace STFATE
- High Fidelity Contaminant Fate Model

# DMM Products

## PTM for environmental resources

- Problem/Purpose
  - Rapid evaluation for fate of dredged material
  - Quantify constituent and living resource transport
  - Expand PTM to include chemicals and larvae transport
- Solution/Approach
  - Incorporate non-conservative constituent transport into PTM (ex: volatilization)
  - Incorporate larvae behavior into PTM parcels
  - Demonstrate applicability



- Products
  - TN: Volatilization/chemical reaction TN
  - TN: Larvae behavior
  - TR: Demonstration of larvae behavior

# DMM Products

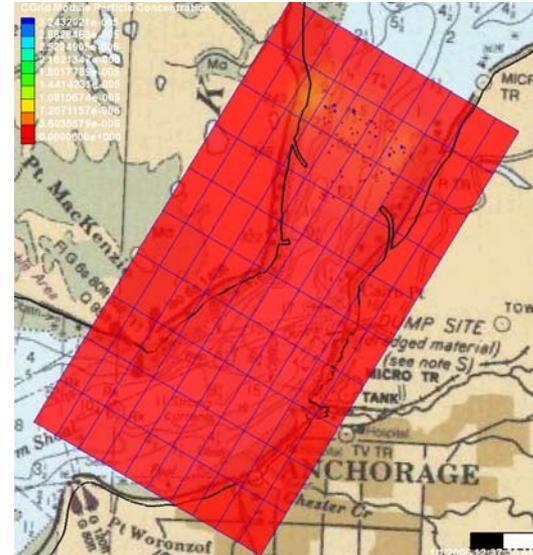
## SMS Framework for DMM Tools

- Problem/Purpose

- DMM tools have no common interface or interconnectivity
- Develop common interface to improve DMM tool application and analysis
- Interconnect DMM tools with external models, databases

- Solution/Approach

- Incorporate new dredging models and tools into SMS
- Integrate dredging models and USACE large domain models
- SMS interacts directly with GIS, NOAA data, etc
- SMS has large District user base



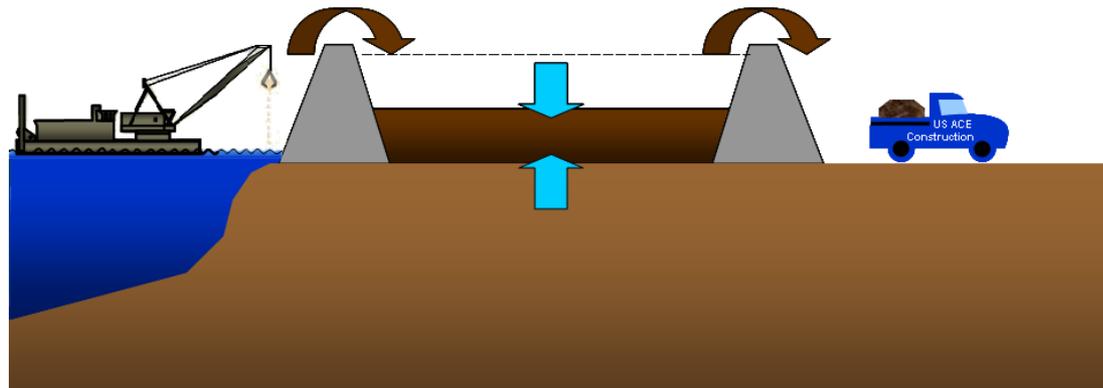
- Products

- PTM in SMS (v3)
- Incorporate external hydrodynamics in PTM
- C3SHORE in SMS
- GIS data for DM models

# CDF Sustainable Strategy Development

- **Purpose:** To develop a strategy by which the resources for managing dredged material are perpetuated through efficient use and management of CDFs, supported by innovations in management before and after placement, and in CDF concept, design and siting.
- **Product:**
  - Bailey, S. E., T. J. Estes, P. R. Schroeder, T. E. Myers, J. D. Rosati, T. L. Welp, L. T. Lee, W. V. Gwin, and D. E. Averett. 2009. *Sustainable confined disposal facilities for long-term management of dredged material*. DOER Technical Notes Collection. ERDC TN-DOER-xx. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

$$\text{Capacity} = \text{CDF size} - \text{Material Added} - \text{Space Occupied} + \text{Material Removed}$$



# CDF Management

- Desalination of Dredged Material
  - Salinity limits some BU applications
  - Develop guidance for desalination
- Sampling Analysis Protocols
  - Existing CDF material poorly characterized
  - Reuse limited because of this poor characterization
  - Develop protocols for characterizing existing CDFs
- Risk Assessment and Management
  - Legacy contaminants exist in CDFs
  - Develop appropriate risk assessment tools to optimize reuse
- Suitability of Dredged Material for Beneficial Uses
  - CDF or DM alone may not be appropriate for BU
  - Suitable applications must be found or developed

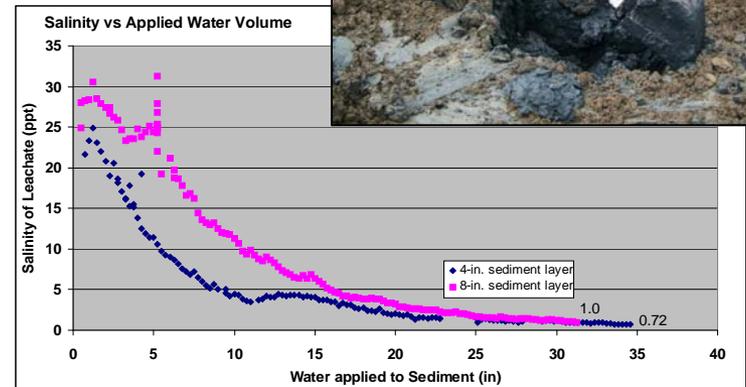
# DMM Products

## Desalination of Dredged Material in CDFs for Reuse

- Problem/Purpose
  - Evaluate passive techniques for desalination of fine-grained dredged material
  - Desalination would expand the range of upland beneficial use opportunities.
  - Beneficial use is required for CDF sustainability

- Solution/Approach

- Lab testing of desalination scenarios, impacts of:
  - Tillage
  - Flooding
  - Desiccation
  - Drainage
- Calibrate models for design application



- Products

- **Tech Note:** “Guidance for Desalination of Dredged Material in CDFs for Reuse”
- **Journal Article:** “Desalination of Dredged Material in CDFs”

# DMM Products

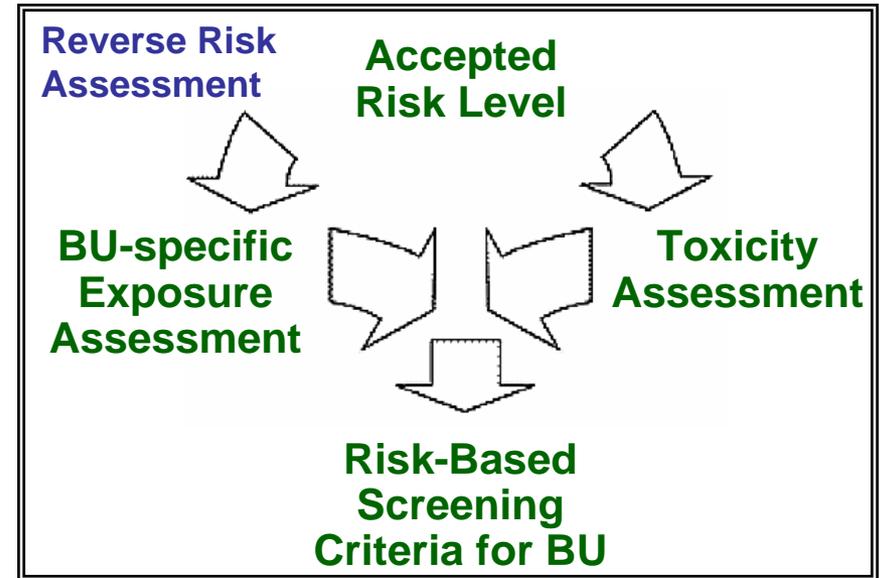
## Establishment of Risk-Based Criteria for Beneficial Use

- **Problem/Purpose**

- Beneficial use of dredged material is hampered by a lack of consistent criteria to readily determine environmental acceptability
- Methodology for generating criteria is needed.

- **Solution/Approach**

- Develop methodology based on risk principles
- Apply methodology to a given contaminant
- Collaborate with States and EPA to gain acceptance



- **Products**

- Methodology for developing risk-based criteria for the application of dredged material for potential beneficial use scenarios
- TNs, TRs, and JPs

# DMM Products

## CDF Sampling/Analysis Protocols

- Problem/Purpose

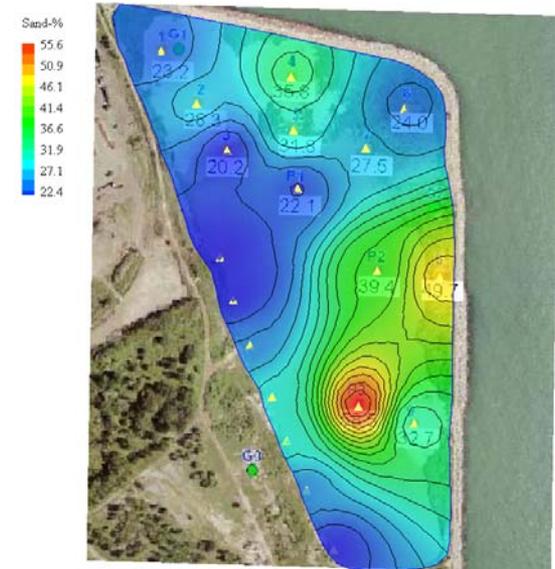
- Diminishing CDF Capacity
- Need CDF sampling protocols tailored for
  - material recovery & BU characterization
  - minimizing sampling requirements and characterization uncertainty

- Solution/Approach

- Review existing CDF data
- Compile sampling and compositing guidance
- Bench testing and desktop analysis of sampling and analytical variability

- Products

- TN: CDF Characterization – What We Know
- TN: Characterizing Dredged Material with Confidence
- Peer-reviewed JPs and TRs



# DMM Products

## Beneficial Use Testing Manual

- **Problem/Purpose**

- Develop BUTM for evaluating suitability of dredged material for specific uses
- Field validate/document innovative methodologies for uses of DM

- **Solution/Approach**

- Review existing BU data
- Thorough documentation of BU demonstration projects
- Guidance on suitability of CDF and DM for BU applications

- **Products**

- TN: Use of soil screening levels for BU Suitability
- TN: Regulatory considerations for BU
- BUTM



# DMM Future Projects ?

- Field Input Required
  - RARG, DMAM, contact DOER PM directly
- Aquatic Beneficial Uses
  - Demonstrate applicability
  - Appropriate methods for placement
- Dredging and Placement Operations
  - Far field fate of DM (including plume decay)
  - WQ and constituent fate
  - Optimizing dredging operations within regulatory criteria
- CDF Management
  - Regulatory/public approval for analysis protocols
  - Appropriate uses
- Upland Beneficial Uses
  - Recycling of CDF material
  - Using DM directly for BU

# DMM Future Projects ?

- Dredged Sediment Processes
  - Dredged Material Deposition and Consolidation Processes
  - Mixing, Entrainment, and Settling of Dense Plumes
- Dredging Placement and Controls
  - Near-Field Dredge Plume Evolution
  - Pipeline and Barge Placement Processes - Underflow
- Dredging and Placement Models
  - Pipeline Fluidized Mud
  - Nearshore Placement and Transport Model
- Dredging Project Data and Model Management
  - Interface for Dredging WQ and Contaminant Transport Model
  - GIS data for dredging tools
- CDF Operations and Management
  - Continued Risk-Based Criteria and Sampling Analysis Protocols
  - Continued studies on permitting and suitability
  - CDF Retrofitting for Sustainability