



Comparison of Modeling Predictions with Monitoring Results – Providence River & Harbor Maintenance Dredging Project

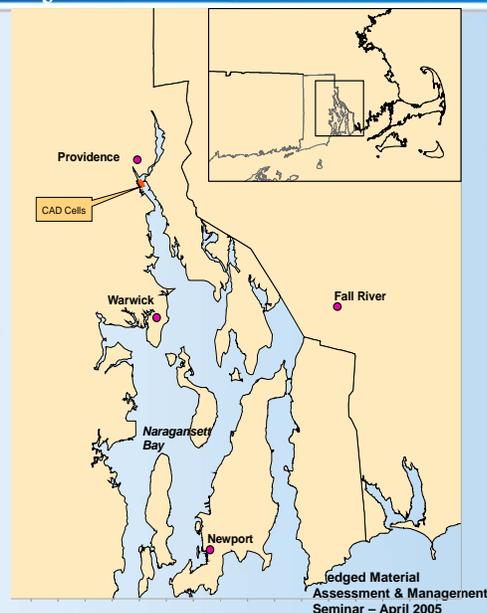
Steven Wolf 

swolf@ensr.com

Key Words: dredged material, disposal, placement model, CAD cell,
turbidity plume

Overview - Providence River & Harbor Maintenance Dredging Project

- Maintenance dredging in the upper reaches of the Providence River & Harbor Channel
- Removal of ~5.8 million cubic yards of material



Overview

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Objective of today's talk – Provide a preview of ongoing work comparing model predictions of dredging and disposal impacts with actual measurements



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Acknowledgements

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Providence River & Harbor Dredging Project

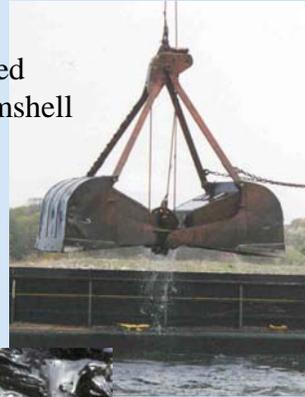
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Mechanical Dredging

Open Clamshell



Enclosed Clamshell



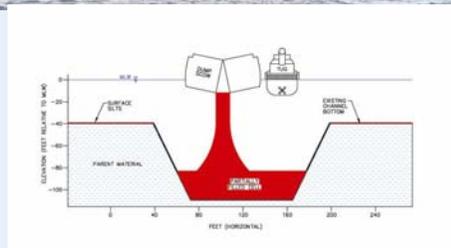
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Disposal - Split-Hulled Scows

- In-Channel CAD Cells
- Open-Water Site



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Overview - Providence River & Harbor Project ⁷

- Predictive modeling performed as part of the EIS – dredging and disposal
- Disposal monitoring performed as required by the Water Quality Certification
- Dredging monitoring performed by ERDC

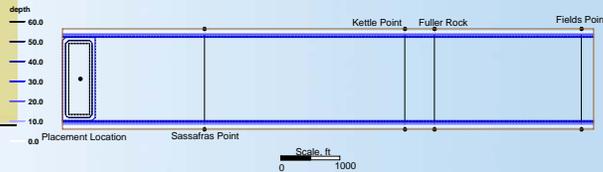
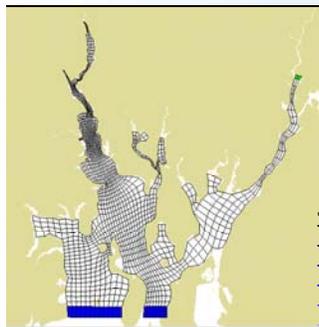
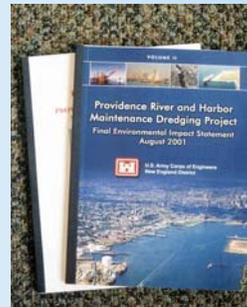


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Predictive Modeling as Part of Project EIS ⁸

- Dredging impacts - ASA
- Disposal impacts - ERDC



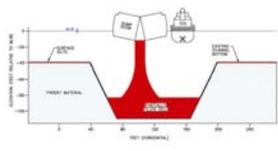
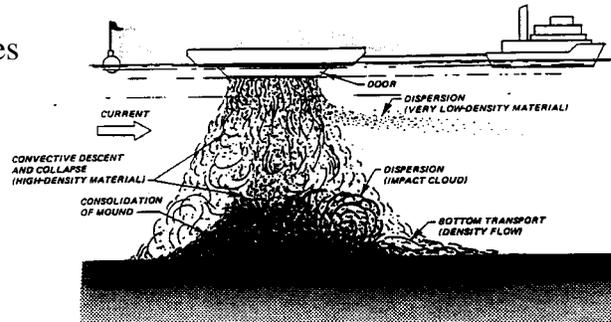
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Disposal Modeling - Approach

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STFATE – simulates descent, collapse, and transport of material released from a split-hulled scow (TSS, elutriate)



SURGE – simulates spreading of the disposed material within the CAD cell to assess containment

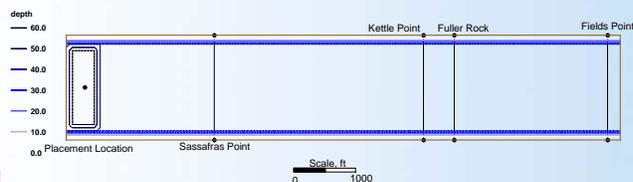
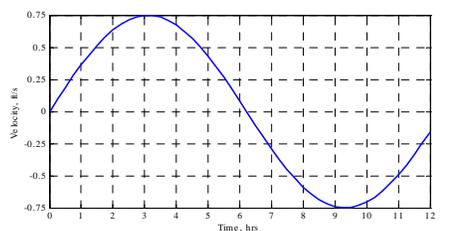


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Disposal Modeling - Assumptions

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- Model domain included ~ 7000 ft of channel
- Representative spring tide conditions (sinusoidal current, peak = 0.75 ft/s)
- 3000 and 6000 cy scows filled to varying levels, 60-80% of solids as clumps, 10-30% free water, 40-60% total water



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Disposal Modeling - Results

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- Discrete TSS plume identifiable several hours after disposal
- Maximum TSS excursion ~80 mg/L, ~2000 ft downcurrent, 1 hour following disposal
- 10 mg/L TSS excursion extends to 4000-5000 ft downcurrent, 2 hours following disposal



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Example of CAD Cell Disposal

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Disposal Modeling - Reaction

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How accurate was the modeling?



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Disposal Monitoring – Equipment

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ADCP - Acoustic Doppler
Current Profiler –
measures acoustic
backscatter throughout the
full water column

Point measurements of
turbidity from an
instrument lowered
through the water column

Sample collection intake
located with the
instrument package

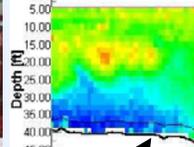


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Disposal Monitoring – Techniques

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- ADCP used to identify and track plume
- Turbidity measured and samples collected from within the plume



Real-time readout

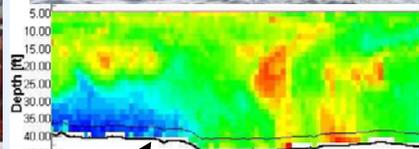


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Disposal Monitoring – Techniques

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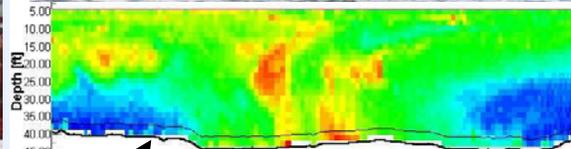


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Disposal Monitoring – Techniques

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Real-time readout

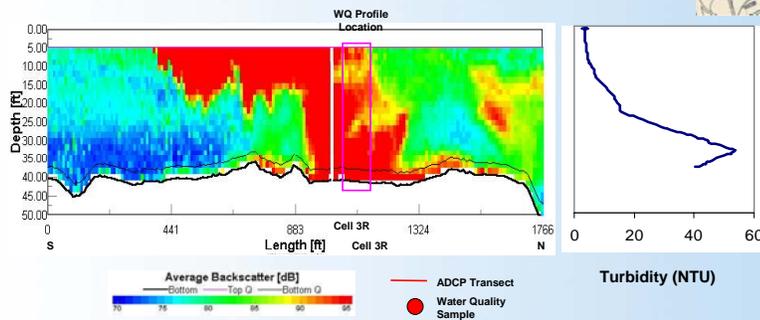


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Disposal Monitoring – Results

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Example of backscatter and turbidity profiles immediately following disposal into CAD cell

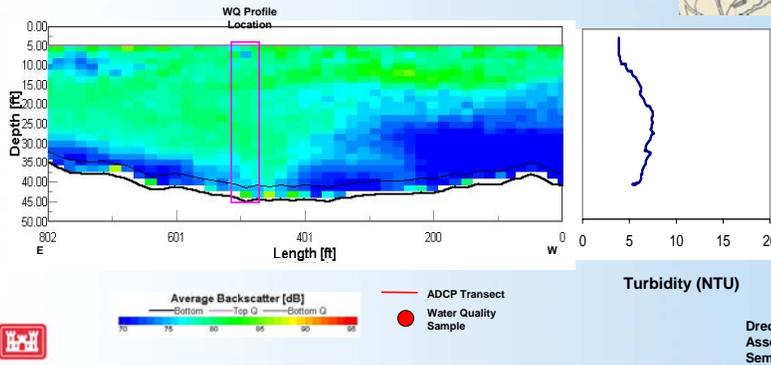
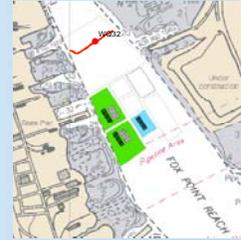


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Disposal Monitoring – Results

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Only a slight elevation in backscatter and turbidity was noted 1500 ft downcurrent of the disposal – note that two dredges were also working adjacent to the disposal



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Predicted vs. Observed Disposal Plume

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Monitoring revealed that a discreet plume extended only a short distance (<1000 ft) beyond the CAD cell boundary

Predicted

60 minutes after disposal



180 minutes after disposal



Minutes after disposal

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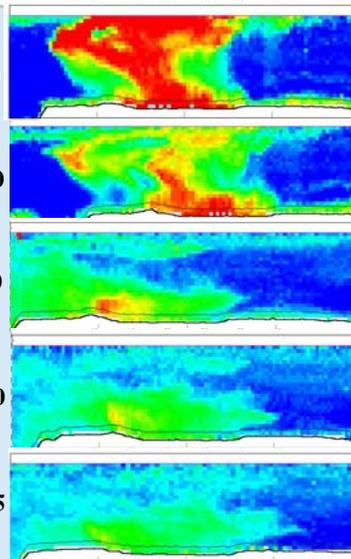
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60

70

85

Observed



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Graphic Simulation of Open-Water Disposal

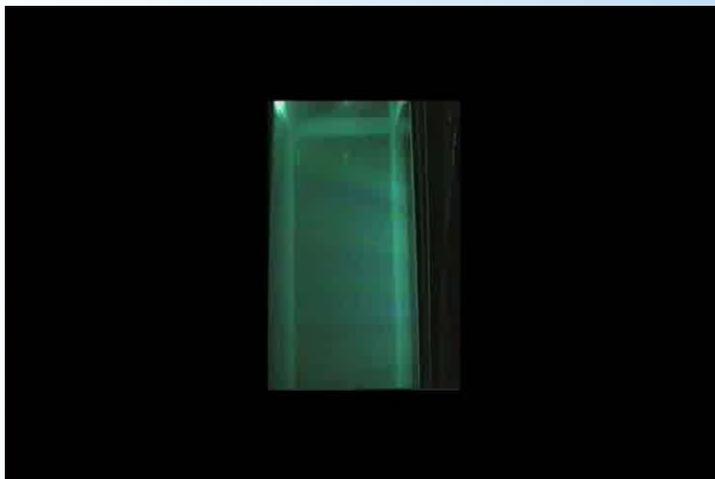
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Laboratory Simulation of Disposal

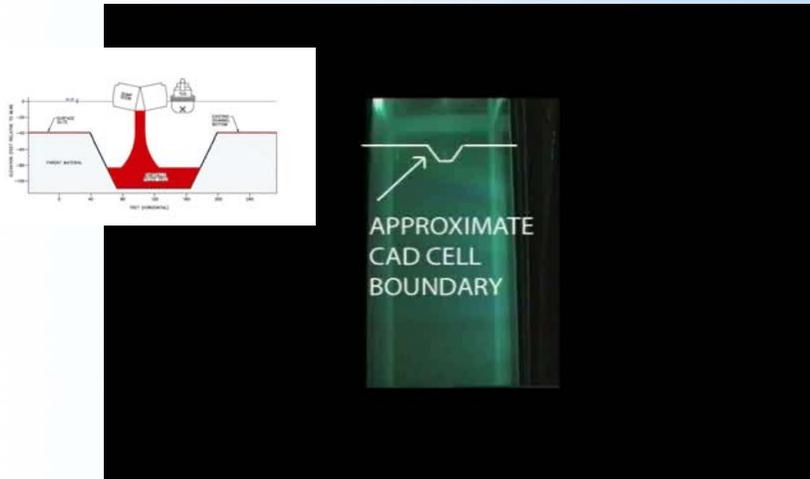
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Laboratory Simulation of Disposal

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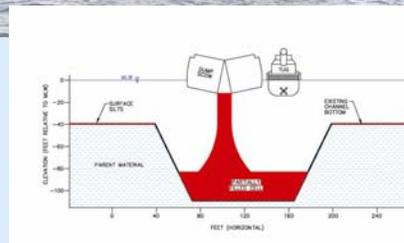


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Disposal into CAD Cell - Predicted vs. Observed

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- STFATE provides a good predictor of potential suspended solids impacts (i.e. somewhat conservative)
- Overprediction of release may be related to the hydrodynamics of disposal into a relatively shallow, confined cell

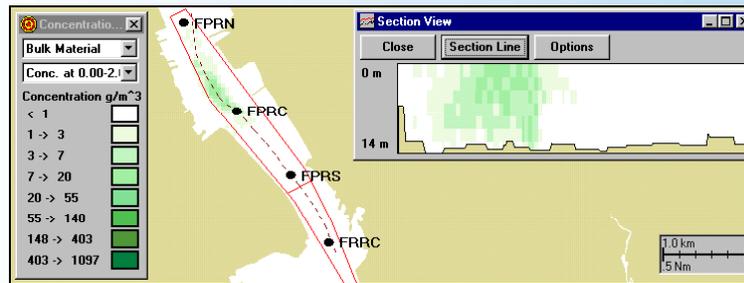


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Dredging Modeling - Approach

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- **WQMAP** - Three-dimensional hydrodynamic model
- **SSFATE** – Transport of dredged material released during dredging operations

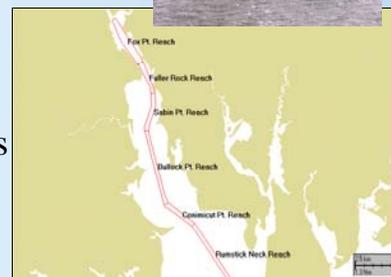
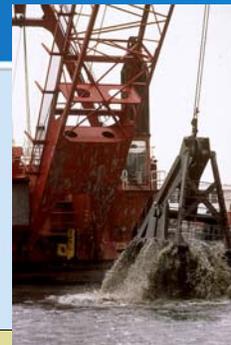


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Dredging Modeling - Assumptions

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- Mean tidal flow, mean river flow, M_2 tidal period
- Four release sites
- Continuous sediment load
- Production rate of 7700 yd^3/day
- Release rate of 1.5 to 4% of production rate
- Vertical load distribution ranges from 40% (bottom) to 5% (surface)



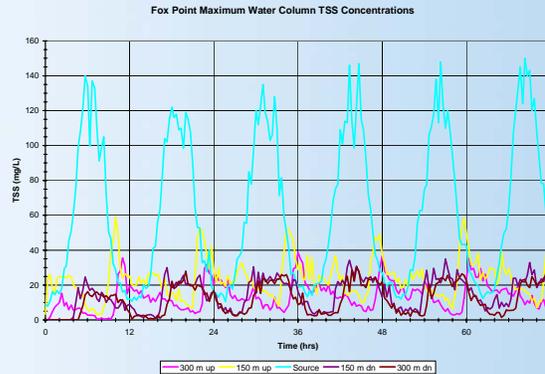
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Dredging Modeling - Results

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Fox Point Reach

- Maximum TSS 54 to 150 mg/L
- TSS dropped to half the maximum value within 500 ft of release



Highest TSS predicted near the bottom

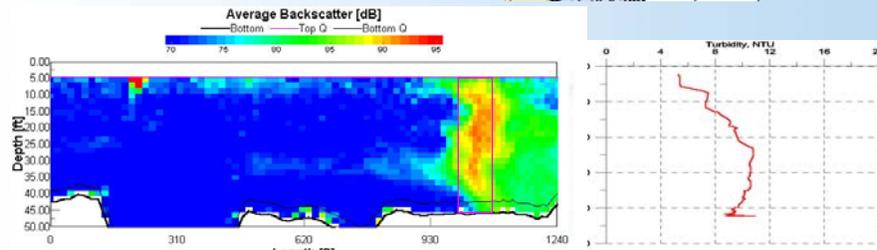
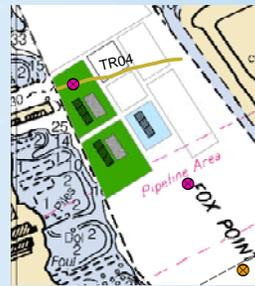


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Dredging Monitoring - Results

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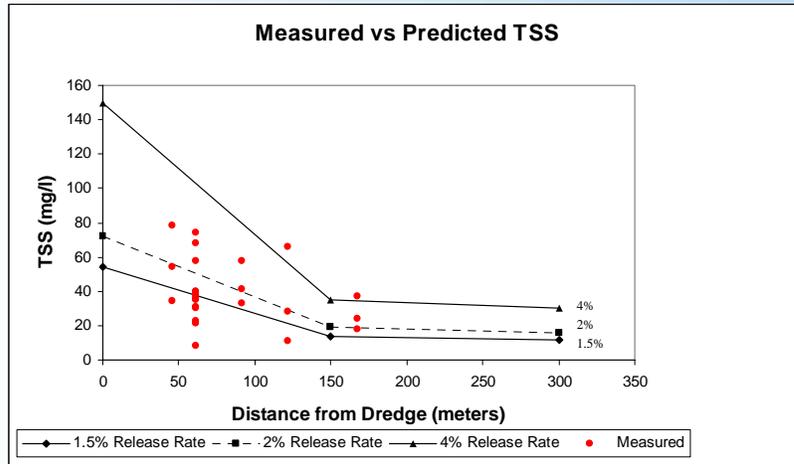
- Limited monitoring required as part of the Water Quality Certification
- Focused monitoring of dredging performed by ERDC



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Predicted vs. Observed Dredging Plume

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Additional Information

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Detailed report summarizing the project and comparing predictions of impacts with the results of monitoring will be prepared over the next year.

Look for information at

www.nae.usace.army.mil/environm/damos/splash_page.htm



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