Environmental Dredging Equipment, Processes, and Operations

EPA/OSRTI Sediment Remedies: Dredging – Technical Considerations for Evaluation and Implementation

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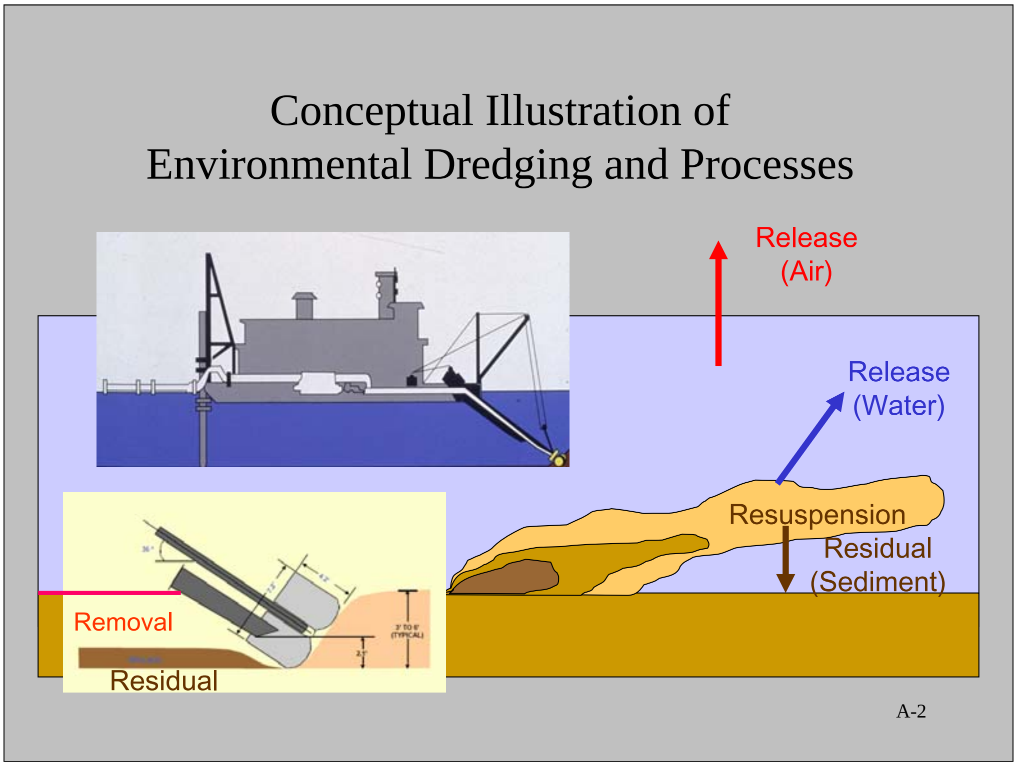
EPA Sediment Remedies Internet Seminar

A-1



EPA uses environmental dredging to characterize dredging performed specifically for the removal of contaminated sediment.

Environmental dredging is intended to remove sediment contaminated above certain action levels while minimizing the spread of contaminants to the surrounding environment during dredging [National Research Council (NRC 1997)].

“Environmental dredging” in the context of contaminated sediment remediation refers to the removal of contaminated sediments from a waterbody prior to treatment and/or disposal. [Palermo, Francingues, Averett 2004]

Leading Technical Issues – Environmental Dredging

- 5-R's
  - Removal accuracy and precision
  - Resuspension
  - Releases
  - Residuals
  - Risk
- Impact of debris
- Compatibility with transport, rehandling, treatment and disposal

(continued) A-3

Dredging usually more complex and costly than in-situ capping or MNR

•need for transport, staging, treatment (where applicable), and disposal of the dredged sediment.

High level of uncertainty with estimating removal effectiveness, resuspension, releases, and residual contamination

•may not meet cleanup levels or remedial action objectives.

Each component of a sediment removal alternative

•necessitates additional handling of the material

•presents a possibility of contaminant loss, as well as other potential risks to workers and communities.

Removal disrupts the benthic environment

•temporary destruction of the aquatic community and habitat within the remediation area

Restrictions require dredging during hard to dredge times of the year – e.g., Fish Windows

Leading Technical Issues – Environmental Dredging

- Dewatering and water quality issues
- Effectiveness of controls (silt curtains, etc)
- Potential conflicts of performance standards
- Dredging Windows (fish, birds, etc.)
- Quality of life issues
  - Noise, traffic, air

(completed)

A-4

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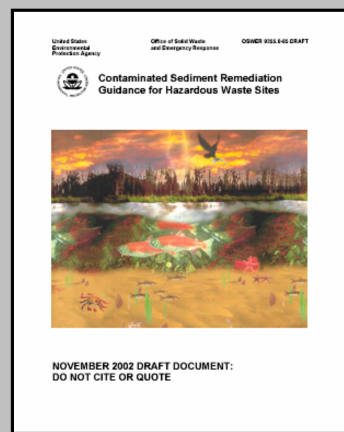
Environmental Dredging – General Guidance

- EPA Superfund Sediment Guidance
  - http://www.epa.gov/superfund/resources/sediment/guidanchtm
- USACE/EPA Environmental Dredging Technical Resource/ Guidance (in review)



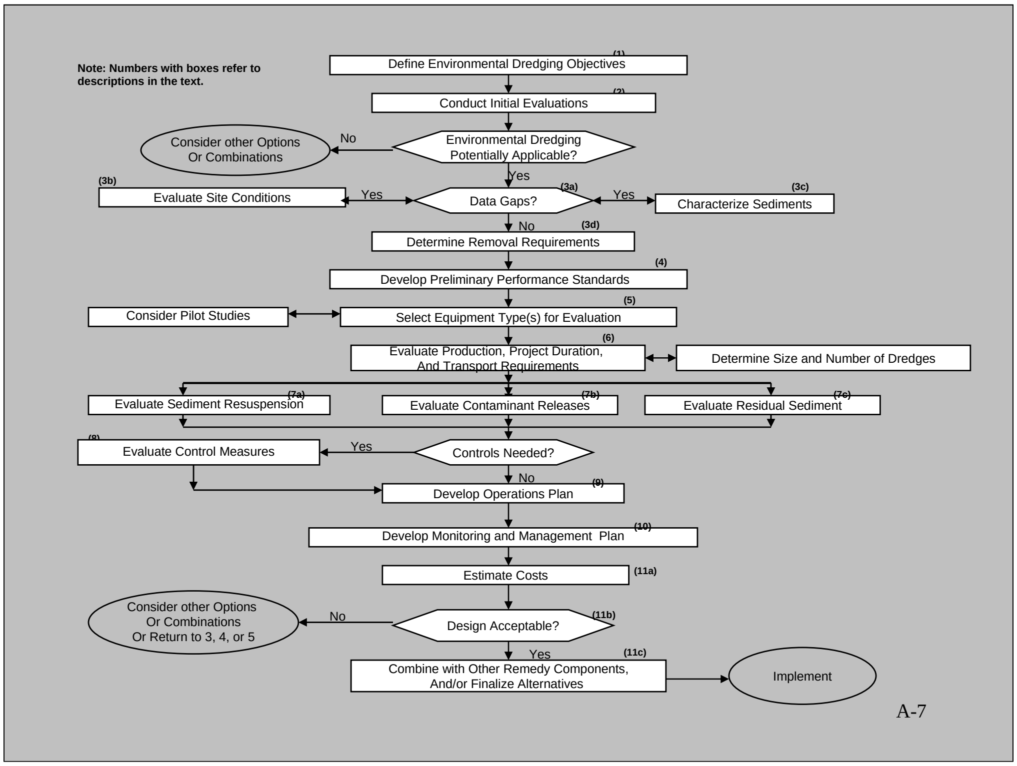
A-5

Major Design/Evaluation Steps

- Define Objectives
- Initial Evaluations
- Site/ Sediment Characterization
- Removal Requirements
- Performance Standards
- Select Equipment for Evaluation
- Production and Duration
- Resuspension
- Release
- Residual
- Control Measures
- Operations Plan
- Monitoring and Management Plan
- Cost Estimates
- Finalize Alternatives and Implement

These steps mirror the content of the Draft Environmental Dredging Guidance.

A-6


Note: Numbers with boxes refer to descriptions in the text.
Define Environmental Dredging Objectives (1)
Conduct Initial Evaluations (2)
Environmental Dredging Potentially Applicable?
No
Consider other Options Or Combinations
Yes
Data Gaps? (3a)
Yes
Evaluate Site Conditions (3b)
Yes
Characterize Sediments (3c)
No
Determine Removal Requirements (3d)
Develop Preliminary Performance Standards (4)
Select Equipment Type(s) for Evaluation (5)
Consider Pilot Studies
Evaluate Production, Project Duration, And Transport Requirements (6)
Determine Size and Number of Dredges
Evaluate Sediment Resuspension (7a)
Evaluate Contaminant Releases (7b)
Evaluate Residual Sediment (7c)
Controls Needed?
Yes
Evaluate Control Measures (8)
No
Develop Operations Plan (9)
Develop Monitoring and Management Plan (10)
Estimate Costs (11a)
Design Acceptable? (11b)
No
Consider other Options Or Combinations Or Return to 3, 4, or 5
Yes
Combine with Other Remedy Components, And/or Finalize Alternatives (11c)
Implement
A-7

EnvDred Objectives

Typical Environmental Dredging Objectives:

- Dredge with sufficient accuracy such that contaminated sediment is removed and cleanup levels are met without excessive removal of clean sediment;
- Dredge the sediments in a reasonable period of time and in a condition compatible with subsequent transport for treatment or disposal,
- Minimize and/or control resuspension of contaminated sediments, downstream transport of resuspended sediments, and releases of contaminants of concern to water and air; and,
- Dredge the sediments such that residual sediment is minimized or controlled.

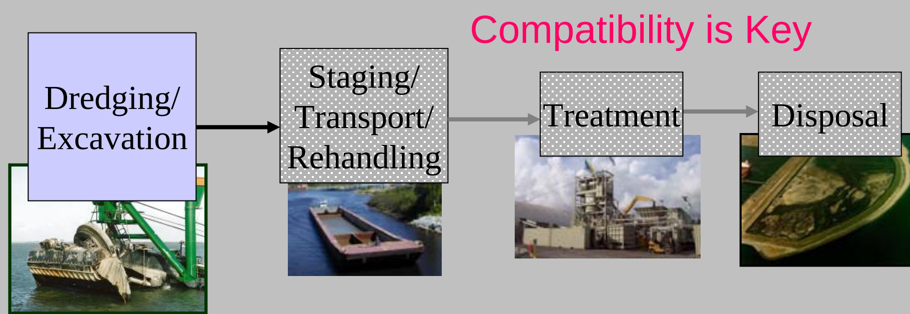
A-8

Factors of Importance

- Site conditions
- Sediment characteristics
- Project dredging requirements
- Equipment selection
- Contractor/operator experience and skill
- Performance Standards

A-9

EnvDred Initial Evaluations



- EnvDred as a remedy component
- Advantages and disadvantages of EnvDred
- Site/ sediment conditions conducive to dredging
- Determine major project constraints

  e.g. non-availability of on-site disposal; high potential for undermining infrastructure; presence of debris, rock or hardpan
- Determine the potential applicability of EnvDred

A-10

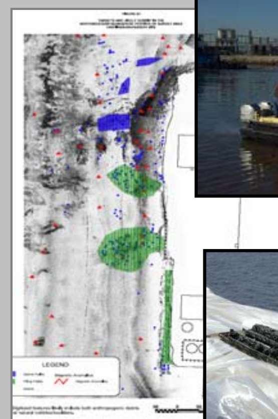
Site Characterization for EnvDred

- Access and navigation traffic
- Background water column conditions (suspended solids)
- Buried debris (wood, concrete, scrap, cables…)
- Boulders, rock, hard pan or “refusal” (overdredge)
- Currents (seasonal, tidal)
- Dredging depth and side slopes
- Slope stability
- Staging areas and disposal area
- Transport routes for barges or pipelines

A-11

Env Dred Site and Sediment Investigations

- Identify Data Gaps
- Develop/refine Conceptual Model
- Site Conditions (Field Investigations)
  - Hydrodynamics; Geotech; Bathy; SS Sonar; Sediment Profiling; Infrastructure; etc.;
- Sediment Characteristics (Sampling)
  - Physical – density, GSD, etc.;
  - Chemical – Conc of COCs to full depth;
- Define Dredgeability and Removal Requirements
  - Debris removal; Dredging depths; volumes and volume increases



A-12

Debris

A-13

Env Dred Performance Standards

- Action Level – defines potential dredging area/depth
- ARARs – Applicable Relevant and Appropriate Requirements
- Production – time limit for completion
- Resuspension/ Release – WQ/air standards and PofC
- Effectiveness (Residuals) – tied to action level and areas of compliance
- Quality of Life – limits on light, noise, traffic, etc.

Evaluations of 4Rs and the potential need for controls must consider performance standards

A-14

Equipment Selection

- Selection needed at Feasibility Study, Remedial Design, and implementation phases
- Wide range of suitable equipment is available for environmental dredging
- No single dredge type is best for all projects
- Selection depends on a number of factors
  - Objectives, goals, and standards
  - Inherent capabilities of equipment
  - Site, sediment, and project conditions (incl. magnitude of debris)
- Evaluate/select based on field experience, predictive tools, and field trials as needed

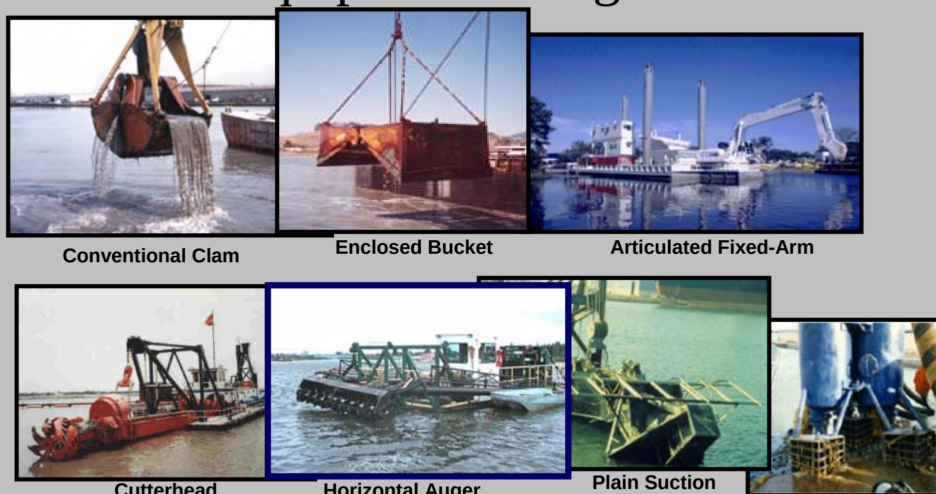
A-15

Equipment Selection – Considerations

- Selection depends on a number of factors
  - Objectives Goals and Standards
  - Inherent capabilities of equipment
  - Site and sediment conditions
- Mechanical vs. Hydraulic
- Conventional vs. Specialty
- Size/ Number - Smaller sizes used compared to navigation
- Use of multiple dredge types

A-16

Environmental Dredging Equipment Categories



A-17

Environmental Dredging Equipment Categories

Dry Excavation

Diver-Assisted

Specialty Dredges

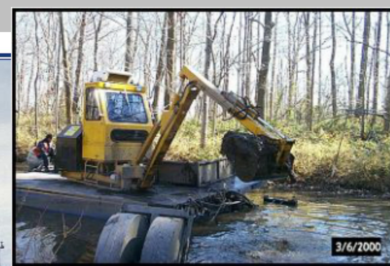
(cont'd)

A-18

Clamshells

A-19

Articulated Fixed-Arm



A-20

Cutterhead Dredges

- Mechanical dislodgement and loosing by dredgehead
- Hydraulic entrainment by suction of pump
- Discharge through a pipeline
- Advancement by spuds, winches and cables

A-21

Horizontal Auger

•Cohesive silts, loosely packed sand

•Sediments sucked up by pump

•Discharge through pipeline

•Relatively level and accurate cuts

•Cuts wide path

•Shroud over auger

•Limited operating depths

•Moderate production

•Transportable by truck

A-22

Specialty Dredges

- Objectives:
  - To reduce resuspension in water
  - To decrease water content during transport
  - To improve accuracy and precision of cuts
  - To provide specialized function
- Variations of closed buckets
- Modifications to the dredge heads
- Improved arms and ladders
- Improved positioning and monitoring instrumentation
- Higher degree of operator training required

A-23

Environmental Dredging – Issues and Processes

- Production
- Accuracy
- Resuspension
- Releases
- Residuals

A-24

Production, Project Duration and Transport

- Operating Production Rate – while dredge is actively operating
- Sustained Production – over a season
- Estimates based on operating parameters; CEDEP; etc.;
- Determine project duration/ number of dredging seasons;
- Dredging system design; numbers of barges, rehandling requirements;
- Determine number and sizes of dredges required;

A-25

Constraints on Production

- Constraints on production related to operations and sediment
  - Thickness of cut; presence of debris; advance speed of the dredge; control measures, access, etc.
- Constraints related to rehandling/ treatment/ disposal capacity.
- Constraints related to “quality of life”.
- Sustained Production rates for Environmental Dredging have been LOW.
- Most completed projects to date involved comparatively small volumes.

A-26

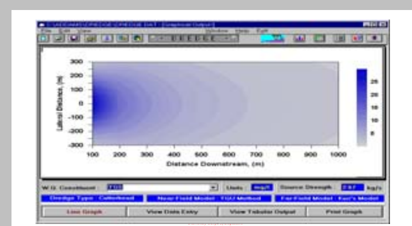
Removal accuracy

- Precision = removal of CS without removing clean material
  - Positioning only locates the dredgehead
  - Attainable precision now at +/- several inches
- Precision of positioning may outstrip that for sediment characterization

A-27

Sediment Resuspension

- Resuspended Sediment = dislodged bedded sediment dispersed to the water column
- Estimates based on field data or empirical or analytical models (e.g. DREDGE)
  - Source Strength Estimate
  - Dispersion Modeling
- Determine need for controls



A-28

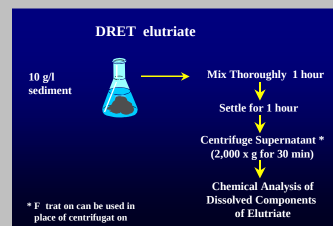
Sediment Resuspension

- All dredges resuspend sediment
- Models available for “source strength” and transport
- Field measurement methods are not consistent
- Field experience indicates resuspension from dredgehead ranges from less than 1to 2% of mass removed (Hays & Wu, Palermo & Averett) to 0.5% to 9% overall (NRC)
- Place resuspension in context with other sources
- Resuspension is primarily near field and can be controlled (at least partially)

A-29

Contaminant Release

- Contaminant Release = movement of contaminants from the pore water of the sediment bed or from contaminants sorbed to resuspended sediment into the water column (and potentially to the air)
- Estimates bases on partitioning models or lab tests (e.g. DRET)
- Compare to standards
- Determine need for controls



A-30

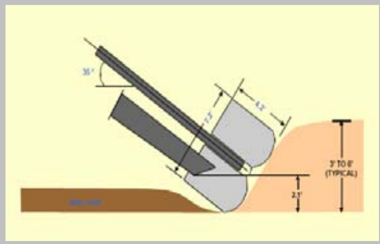
Contaminant Release

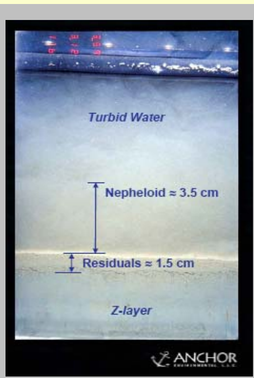
- Resuspension results in releases
- Dissolved release to water column
  - Released porewater
  - Desorption from resuspended particles
- Volatile release from water to air
- Tests/models are available
- Dissolved and volatile releases subject to far field transport – need to evaluate risks accordingly
- In general, CS can be removed without excessive release
- Releases can be partially controlled by controlling resuspension
  - However, there may be contaminant releases with little or no evident TSS release

A-31

Residual Sediment

- Residual Sediment = mass and concentration of contaminated sediment remaining in the area dredged after completion of dredging
- Consider "generated residuals" and "undisturbed residuals"
- Estimates based on field experience or empirical models
- Compare monitoring data (or estimates) to action levels
- Determine need (or potential need) for management actions

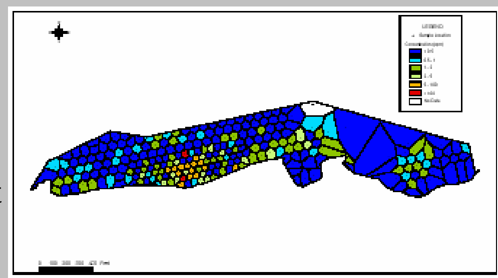




A-32

Residual Sediment

- All dredges leave residual sediment
- No standard predictive method
- Field measurement methods are not consistent
- Multiple cleanup passes show diminishing returns; residual caps are a management option



Reynolds Metals

A-33

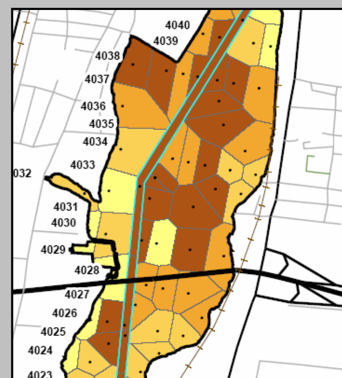
The 4R's are Related

- Removal involves resuspension, release, and residual
- Release is a function of resuspension
- Higher resuspension also results in higher residuals
- Controls for resuspension also effective for release; but may exacerbate residuals
- Releases and residuals increase risk

A-34

Operational Considerations

- Sediment/Dredging Management Units,
- Dredging Prisms
- Sequencing Removal
  - Vertical sequencing
  - Horizontal sequencing
- Methods of Operation
- Operations Plan



A-35

Dredging Prisms

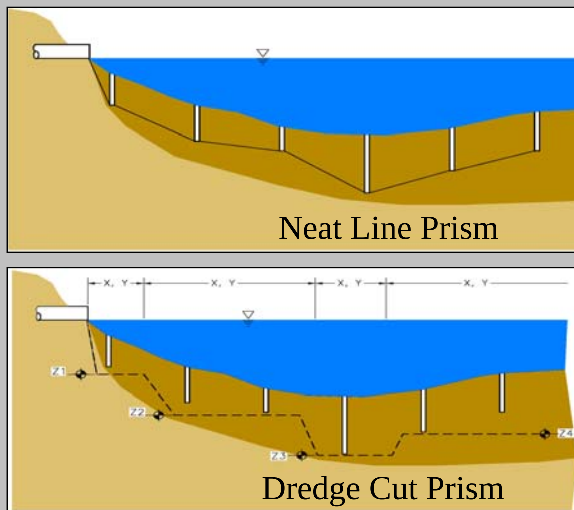
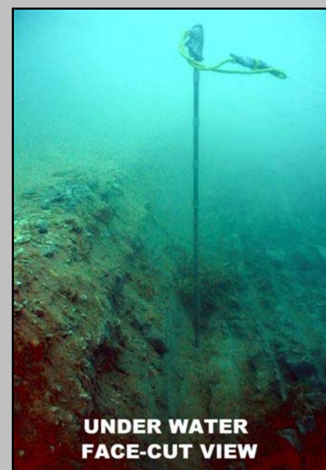


Figure Source: Weber, Harrington, and Fox (2005)

A-36

Cutting on Slopes

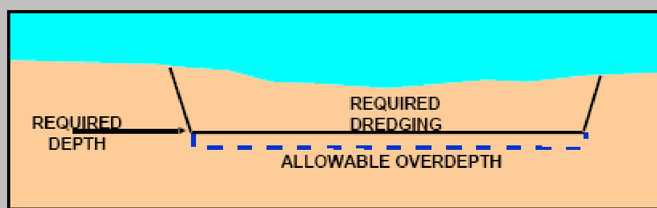
- Box cuts up the slope take more non-target material
- Some specialty dredges can cut parallel to slopes



A-37

Overdredge Allowances

- Overdredge allowance should be tighter for Environmental Dredging as compared to Navigational Dredging
- 6 inches is the “state of the practice” – possible performance specification
- Incentives – Bonus for minimal overdredging
- Disincentives - Penalties for excessive overdredging



Source: USACE Dredging Fundaments 2004

A-38

Methods of Operation

Manistique – outriggers used to control positioning of auger dredge

A-39

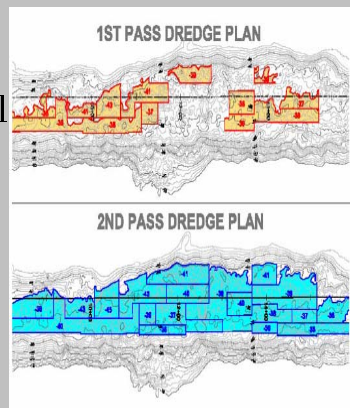
Methods of Operation

Manistique - Diver operated suction using dual heads from dredge pumps

A-40

Env Dred Operations Plan

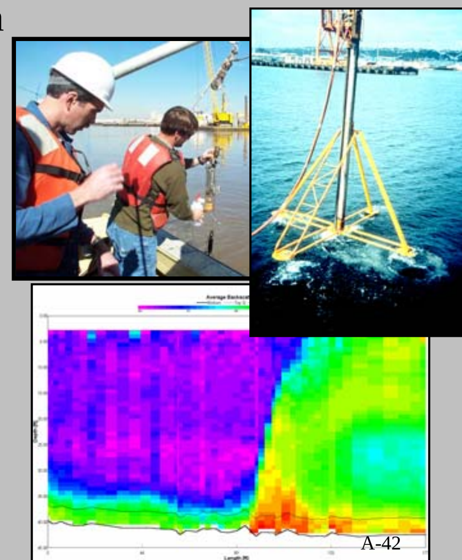
- Define dredging prisms, DMUs, etc.
- Sequencing of the work (horizontal and vertical)
- Production cuts, box cuts, layback slopes, cleanup passes
- Overdredging allowances
- Methods of operation
- Written Operations Plan



A-41

Env Dred Monitoring and Management Plan

- Construction vs. Long Term
- Removal
  - Interim and final bathy
- Resuspension/Release
  - ADCP; Turbidity; TSS/COC samples; Fixed air monitoring stations; etc.;
- Residuals
  - Pre- and Post-removal grabs or cores
- Written plan with pre-determined management



A-42

Environmental Dredging Conclusions

- Environmental Dredging is complex, and a technically sound design requires an efficient and comprehensive evaluation;
- Evaluations may follow a logical progression, but iterative evaluations may be required;
- Implementability, Effectiveness, and Cost should be considered in determining acceptability of an environmental dredging design;
- Environmental dredging design should be project-specific, sediment-specific, and site-specific; and
- Dredging design should focus on project goals, e.g. risk reduction and project should be monitored to determine if goals are met.

A-43

QUESTIONS?

A-44

Environmental Dredging Control Measures and Management

EPA/OSRTI Sediment Remedies: Dredging — Technical Considerations for Evaluation and Implementation

October 23, 2006

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Control Measures for Environmental Dredging

- Establish need for controls
- Select dredging equipment
- Use BMP’s (Best Management Practices)
- Import experience gained from other projects

Needs for Control Measures

- Resuspension
- Release
- Residual
- Risk

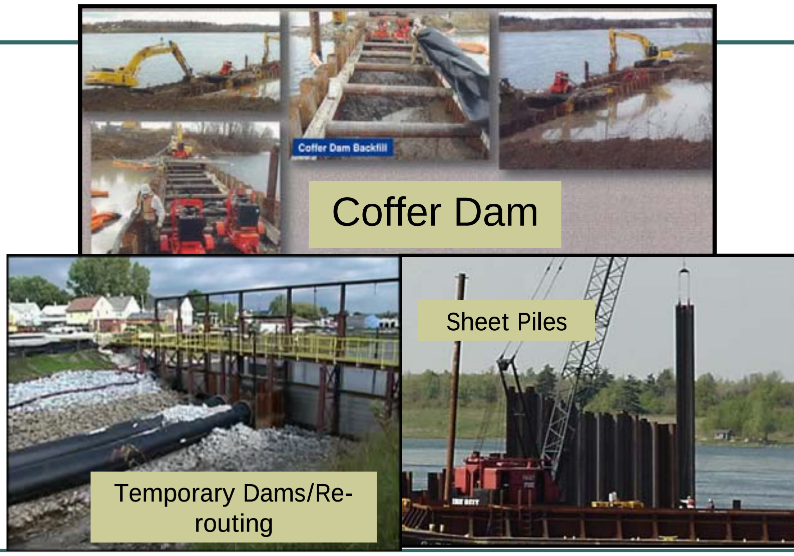
4-R's represent the primary drivers for controls

Types of Controls Possible

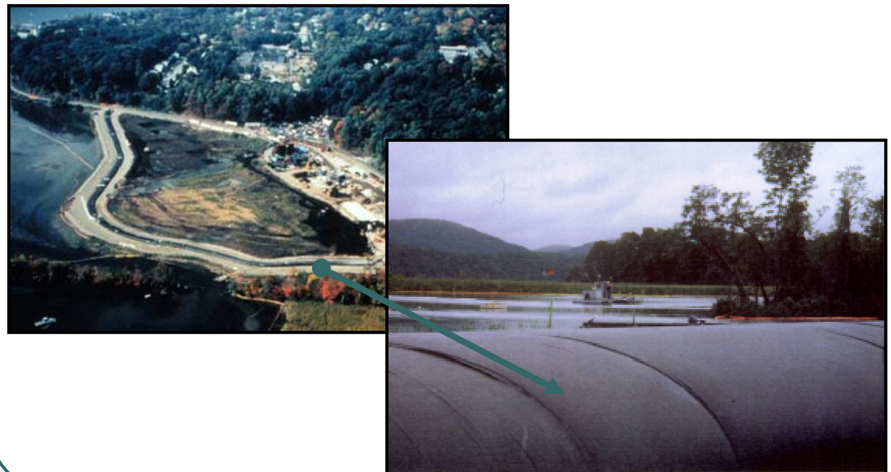
- Structural
  - ✓ Coffer dams
  - ✓ Sheet piles
  - ✓ Removable Dams (Portadam, Geotubes)
- Operational
  - ✓ Silt Curtains
  - ✓ Silt Screens
  - ✓ Oil booms
  - ✓ Pneumatic (Bubble) Curtains

"Select types of controls on a case-by-case basis"

Structural Measures



Portable Water Filled Dam



Leaks during filling; Floated on high tides, constantly patching holes resulting in high maintenance costs, ice punctures, needed to do a lot of site observations/surveillance to see that the tubes were ok.

Operational Measures

Silt Curtain

Bubble Curtain

Aerial View Controls

Environmental Dredging Control Measures and Management B-8

This is a photo of the completed containment system at Massena Reynolds Metals Site on St. Lawrence River. The sheet pile wall, the silt curtains, and the air curtains. **3,800 linear feet of sheet pile**

- **1,500 linear feet of silt curtain**
- **3 air gates**

Air Curtain – Gate & Manifold

Environmental Dredging Control Measures and Management B-9

This is a photo of the air curtain pipes. What' wrong with this picture?

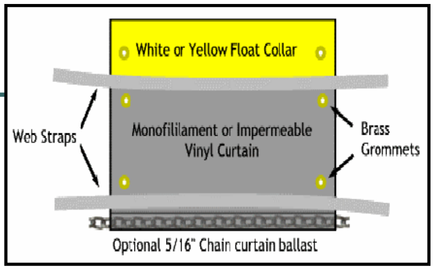
The air nozzles are positioned 360 degrees around the pipe, they should have pointed only up- eventually divers wrapped the pipes with filter fabric on the bottom- which got caught in boat props.

Silt Curtains

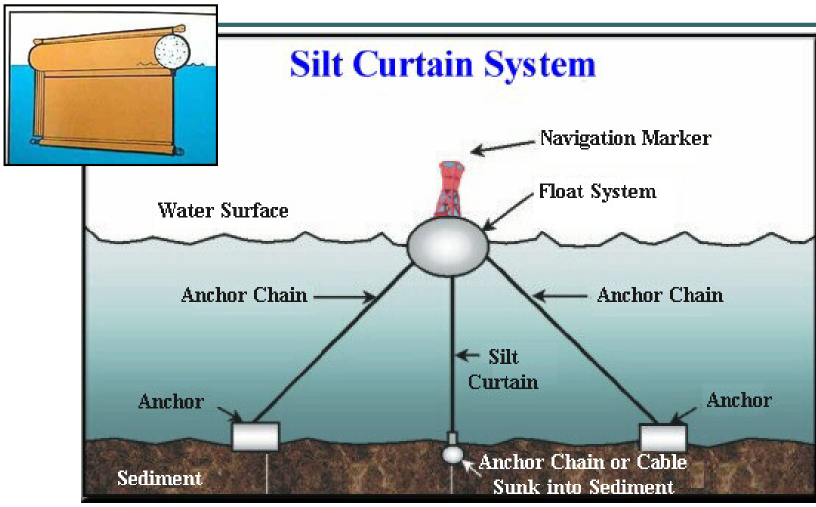
Environmental Dredging Control Measures and Management B-10

Types of Curtains

- Floating and hanging
- Solid diversion baffle
- Permeable or filter
- Standing frame sinkable hanging, combinations
- Name is based on water or current (e.g., slack, medium, fast, rough, tidal, etc.)
- Issue – will curtain contact bottom or stop short?



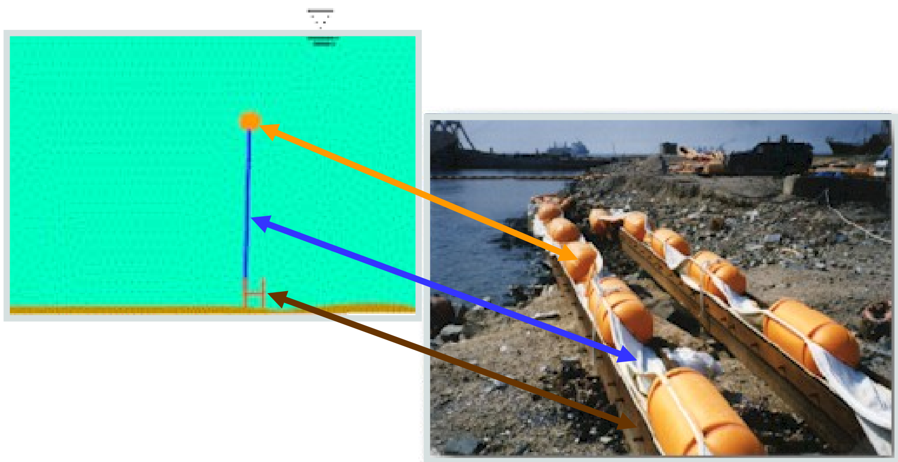
Typical Floating



Mechanical Grab & Barge Operating Inside Hanging Curtain

Environmental Dredging Control Measures and Management B-13

Typical Standing Curtain



Environmental Dredging Control Measures and Management B-14

Delivery & Assembly

Environmental Dredging Control Measures and Management B-15

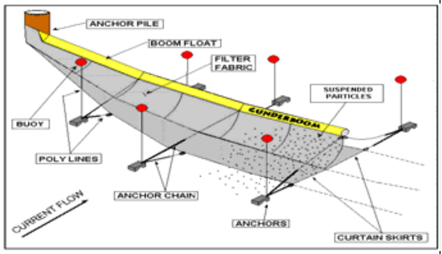
Assemble & Deploy By Boat

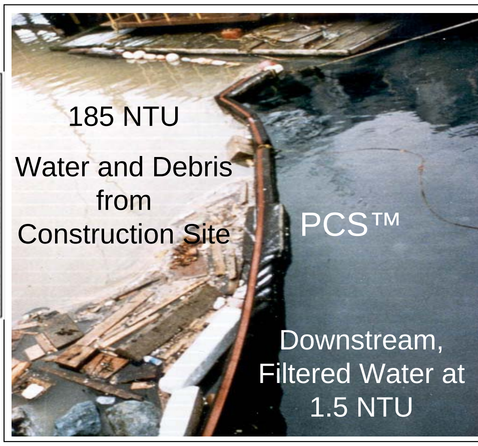
Installation with Piling

Environmental Dredging Control Measures and Management B-17

Silt Curtain deployment at Massena, NY on St. Lawrence River

Specialty Curtains & Booms





GUNDERBOOM
Engineered Aquatic Filter Barrier Systems

Black Lagoon – Detroit River

Environmental Dredging Control Measures and Management B-19

<u>Silt Curtains</u> –

a. Originally, a single, solid vinyl sheet curtain full depth (maximum of 30 ft) was deployed with conventional anchors at the dredging site in Fall 2004. Turbidity monitoring was intensive inside outside curtain and river until river iced over. Curtain had problems containing turbidity due to scouring around/under the bottom of the curtain.

b. A secondary curtain was installed around the primary one (see photo of site showing this installation). This new curtain incorporated fine mesh panels or filtering panels.

c. Anchorage has been difficult with various types used – from traditional anchors to H-beam driven piles. River flow (velocity) was the problem along with ice.

<u>Oil Booms</u> – Originally, EPA had concerned about releases of oil since the source of contamination is immediately upstream from an old Steel Mill. So far, there has been no oil surfacing, no evidence of sheens on the water.

<u>Wavier</u> – The State of Michigan suspended a wildlife dredging window restriction so they could continue to dredge during the normal prohibition timeframe. It seems that the State being a cost-sharing partner had motivation to suspend (waive) the restriction. Also, a PRP was asking the State for a similar waiver on one of their projects but the State has resisted.

Case Examples

Site	Effective	Comments	Reference
New Bedford Pilot	Yes	During Dike Construction	Averett, et.al., 1990
New Bedford Pilot Operations	No	During Operations, Tidal fluctuation and Wind Damage	Averett, et.al., 1990
GM Massena	No	Dye Test & Sheet Piles Added	Averett, et.al., 1990
Sheboygan River 1990-1991	Yes	Curtain & Screens in < 2 meter water depth	Averett, et.al., 1990
Halifax Harbor, Canada	Yes	400 mg/L inside and 5 mg/L outside curtain	USEPA 1994 (ARCS Guidance)

Silt curtains have been used at many locations with varying degrees of success.

Fox River SMU 56/57

Location	Average Turbidity (NTUs)				
	Aug-99	Sep-99	Oct-99	Nov-99	Dec-99
FJI	46	46	29	31	16
USO	46	40	21	18	9
USI	49	44	24	21	16
SSO	43	35	21	20	11
DSO	41	33	25	22	20
DSI	38	35	31	33	20

- Fort James water intake (FJI)
- Upstream of the dredge area outside the silt curtain (USO)
- Upstream of the dredge area inside the silt curtain (USI)
- Sidestream of the dredge area outside the silt curtain (SSO)
- Downstream of the dredge area outside the silt curtain (DSO)
- Downstream of the dredge area inside the silt curtain (DSI)

Source: ***Montgomery Watson - 2001***

Fox River SMU 56/57
Summary of Turbidity Data

- The evaluation of **extensive real-time** turbidity data **within and outside** the silt curtain showed **inconsistent**, and generally **insignificant**, differences.
- The data indicates **dredge induced turbidity was minimal to negligible** at a distance **tens of feet to a few hundred feet** from the dredge.
- Often the **dredge-induced** turbidity near the silt curtain **could not** be readily discerned from the background variability of turbidity during non-dredge periods.

Note: Turbidity does not directly correlate with contaminants.

Why Some Curtains haven't worked!

- Improper selection, design, and/or installation (e.g., improper mooring, deployment configuration, misalignment, etc.)
- Currents greater than 1-1/2 knots (2-1/2 ft/sec) are problematic and can lead to a CATCH-22 situation.
  - ✓ In low currents, turbidity is localized so is a silt curtain even necessary?
  - ✓ In high currents, turbidity spreads, but silt curtains are very difficult to maintain properly, thus less effective
- High winds can lift large curtains out of the water (like a sail)
- Sinkage problems due to excessive biological growth

Typical Damage

- Typical curtain damage may include:
  - ✓ Ripped seams, broken anchor lines
  - ✓ Damaged floats
  - ✓ Tears in the skirt
  - ✓ Metal joint failure, and
  - ✓ Broken cables during spud barge movement.
- Extensive curtain failure includes lost sections and lost anchors.
- More severe damage may occur during high flow events.

Effectiveness Depends on:

- Type of suspended material
- Method of deployment (full depth vs partial)
- Hydrodynamic conditions
  - ✓ strong currents [>1 knot or 1.5 fps]
  - ✓ high winds [especially with long fetch areas]
  - ✓ fluctuating water levels [i.e., tides, locks, seiche events]
  - ✓ excessive wave height, including ship wakes
  - ✓ drifting debris and ice
- Site Conditions
  - ✓ water depth (generally < 20 ft), slopes, debris

Environmental Dredging Control Measures and Management B-25

Slopes make it difficult to use silt curtains, that is to eliminate excursions around the curtain.

Silt Curtain Bottom Line

- Not a ***one solution fits all*** type of best management practice
- Is a highly specialized, ***temporary-use*** device
- Selected only after ***careful evaluation*** of the intended function.
- Designed based on ***detailed knowledge*** of the site where it will be used
- Budget for maintenance and repairs

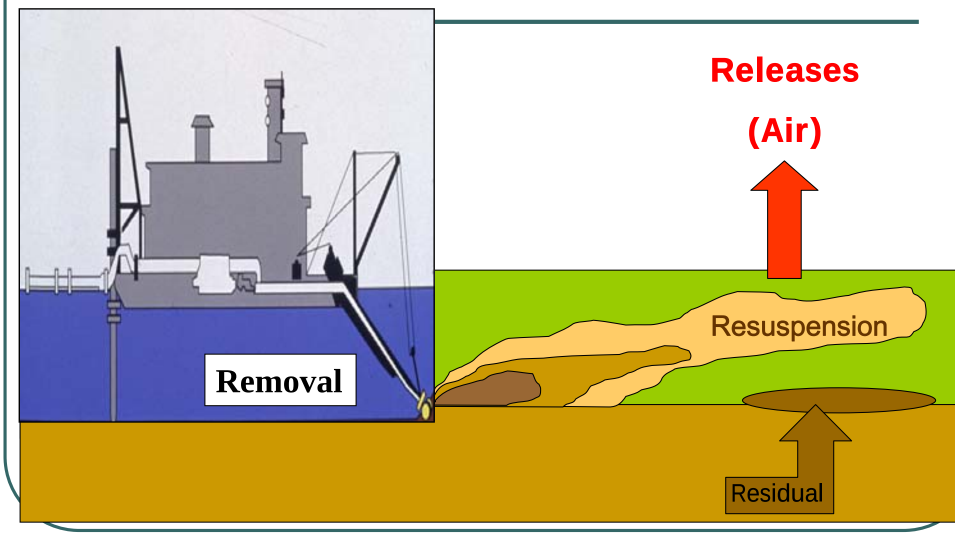
Silt Curtain Guidance

ERDC TN-DOER-E21
September 2005

Silt Curtains as a Dredging Project Management Practice

- **ERDC DOER-TN-E2 –**
- **http://el.erdc.usace.army.mil/dots/doer/doer.html**

Additional Controls May Be Needed



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Controls for Residuals

1. Additional cleanup pass
2. Placement of a thin layered cap of clean material (few inches) to mix with the residual sediment
3. Placement of an Isolation Cap which is the same as a thick layer used for *in situ* capping.

Controls for Volatiles

- At the dredging site
  - ✓ Control measures are based on
    - Nature of the site conditions
    - Very contaminant and site specific
- During transport
  - ✓ In barge or pipeline
- During offloading
  - ✓ Mechanically or hydraulically

VOC Control Measures

- Reducing dredging production rates to minimize resuspension and releases.
- Overlapping dredge passes to minimize resuspension at edge of cut where sloughing may occur.
- Modifying dredgehead to retain oils.
- Decreasing the sweep speed of the cutterhead.
- Degassing pipeline before discharging into onshore facility.
- Covering the dredged material with physical barriers such as (foam), plastic liner, or absorbent mats or materials.

Controls for Noise & Light

- Noise
  - ✓ Establish operating levels for equipment
  - ✓ Modify work schedule, Cease night operations
  - ✓ Install adequate muffler systems or sound dampening methods or enclosures.
- Light
  - ✓ Re-aim and shield lighting to reduce light spillage
  - ✓ Inform the public on operations with monitoring data (real time is possible with websites)

Geotextile Fabric (Acoustical Control)

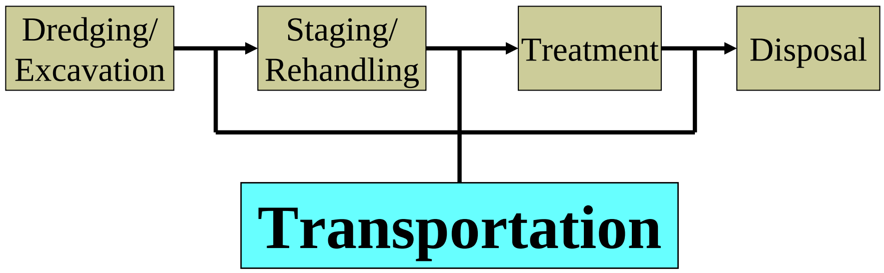
Project Managers Should:

- Recognize unique project features that may require a site-specific application and adaptation of control measures.
- Be aware of the increased potential for scour to occur around the outside of structural controls (sheet piles, coffer dams, etc.).
- Be aware that sheet piling can change the carrying capacity of a stream or river making it temporarily more susceptible to flooding.

Project Managers Should:

- Recognize that all dredging will results in some resuspension that may or may not warrant additional control measures.
- Select silt curtains only after careful evaluation of their intended function.
- Recognize that all dredging will result in some residuals, most warranting additional control measures.
- Be aware that dredging activities can create quality of life issues (e.g., odors, noise, and light) that may need to be addressed, and modifications will have impacts on project production rates and schedules.

Linkages & Management



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Transport Considerations

- Transport distance
- Optimal water content for processing
- Transport must be compatible with rehandling, treatment, & disposal
- Hydraulic - pipeline transport is inherent with removal (batch transport not efficient)
- Mechanical - batch transport by barge is another step in the process train, but reslurry/pipeline is possible, free of debris.

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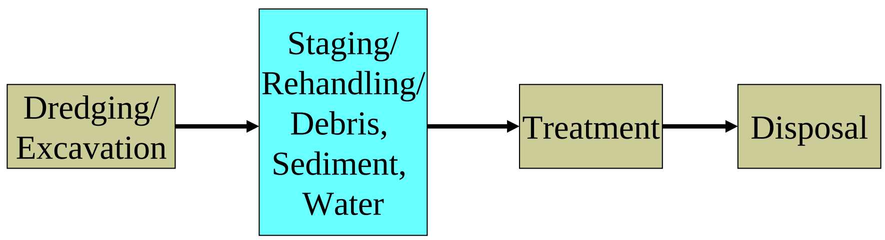
Conveyors – Lake Peoria, IL

Transfer Station

Photos from:

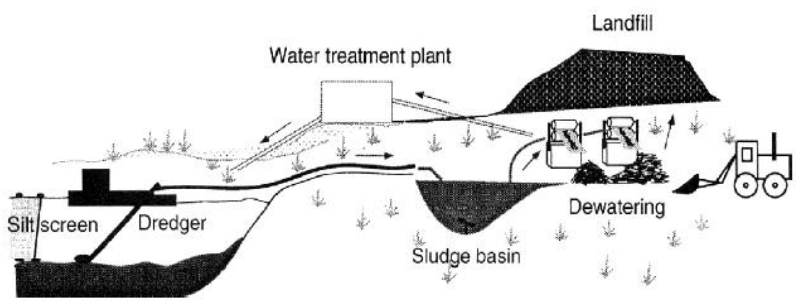
Illinois Department of Natural Resources

Dredging Process Train



Re-handling/Temporary Storage

Highlight 6-8: Sample of Dredging Dewatering Process



Temporary storage may be needed for dewatering or other pretreatment or equalization prior to treatment and disposal.

Hydraulic Offloader

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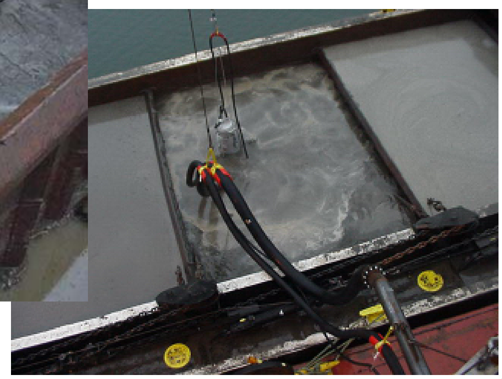
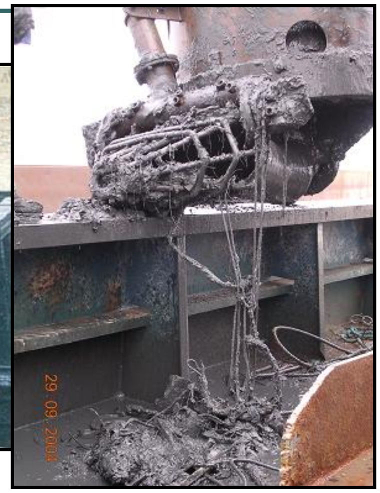
Hydraulic Pump Offloading



Screening Debris



Environmental Dredging Control Measures and Management B-42

Residue After Unloading Barge

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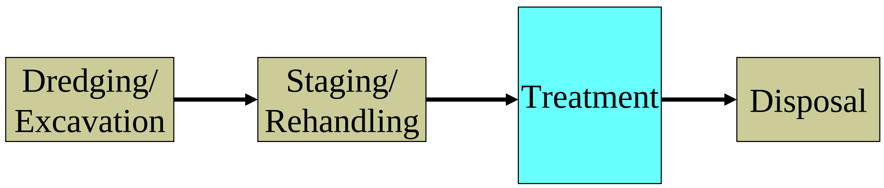
Dredging Process Train



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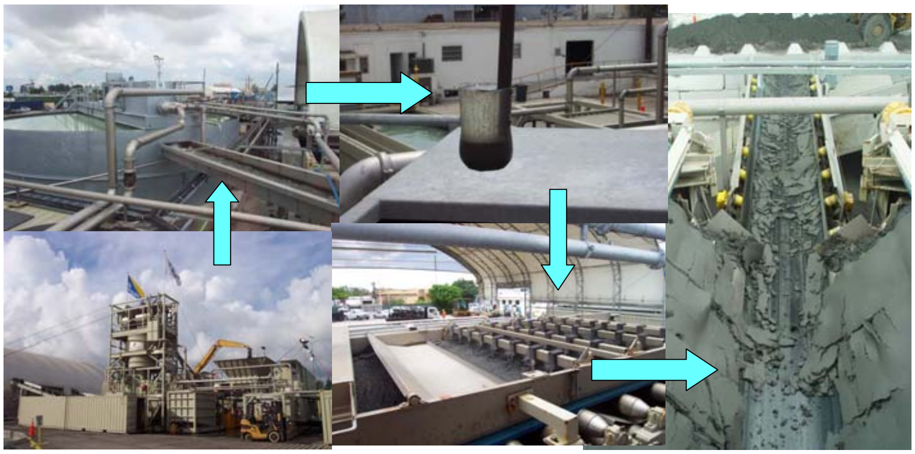
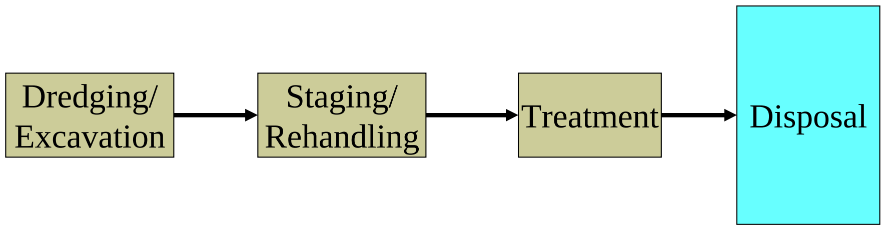
Sediment Treatment

- Advantages
  - ✓ Popular option
  - ✓ Technologies available
  - ✓ SARA preference
- Disadvantages
  - ✓ Can be very expensive
  - ✓ Emissions/ discharges
  - ✓ Pre-treatment may require a CDF
  - ✓ Residual requires disposal and may pose risks

Treatment/Dewatering



Dredging Process Train



Onsite/Offsite Disposal

- Confined Disposal Facility (normally located close to dredging site)
  - ✓ Can be designed to handle Superfund, RCRA, and TSCA materials
  - ✓ Usually a monofill
- Commercial Landfill (transport by truck or rail to offsite permitted facility)

Point Mouille CDF

Environmental Dredging Control Measures and Management B-49

Dredged material from Black Lagoon on Detroit River being disposed into a lined cell at the Corps of Engineers Point Mouille CDF.

Permitted Landfill Disposal

- RCRA prescriptive designs intended for solid waste disposal
  - ✓ Subtitle D – Non Hazardous Waste
  - ✓ Subtitle C – Hazardous Waste
- TSCA Landfills
- Material must pass paint filter test
- State regulations may allow for monofills with greater flexibility in design (e.g. “wet” landfills)
- Generally requires dewatering/solidification
- Fees based on weight, about one ton/cubic yard fine-grained sediment

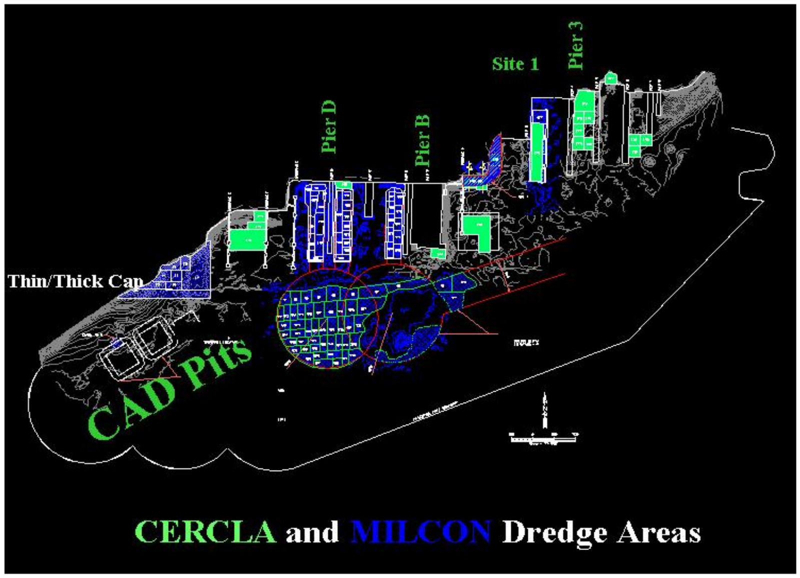
Mixed Stabilized & Compacted Material at Disposal Site

Addition of stabilization amendments

Contained Aquatic Disposal (CAD)

- Subaqueous containment (i.e. a submerged CDF)
- Regulated under Section 404/401 CWA
- Placement by barge, pipeline, etc.
- Natural or constructed pits or diked containments
- Contaminant pathways and control measures similar to in-situ capping

Puget Sound Naval Station CAD



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Attached are some old figures showing the PSNS site and the earlier pit cad design. The only thing that has changed is the reduction from 2 cad pits to 1. The one that was kept is the one in the middle (we dropped the one on the left). The right-most pit is a stockpiling area for clean dredged material from the pit cad. This stockpiled material will be used as the finishing/habitat layer after the 3-ft sand cap has been placed on the pit cad.

Lessons Learned

- Unique nature of contaminated sediment must be considered
- Material variability is important
- CDF for initial offloading can attenuate variability
- A large number of treatment processes can be applied
- Conventional waste water treatment trains are difficult to apply to sediment
- Complex trains are workable but expensive
- Treatment is rarely used beyond dewatering & solidification prior to final disposal

Project Managers

- Should consider the compatibility of all components of the dredging process train, including transport, rehandling, treatment, and disposal of the dredged sediment.
- Should consider potential contaminant losses to the water column and atmosphere during dredging, transport, dewatering, temporary storage, or treatment.
- Should consider the difficulty in removing all sediment from barges, especially when unloading them mechanically.

Project Managers

- Should consider the need to treat water prior to discharge, especially when decontaminating equipment and dewatering dredged material.
- Should included the costs of water treatment in cost estimates for the alternative, and should plan for more water than they expect.
- Should recognize that water treatment costs may also affect choices regarding dredging operation and equipment selection.
- Should evaluate implementation risks, both to workers and to the community, between the various transportation methods.

QUESTIONS?

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Some things you just can't control.

Thank You

After viewing the links to additional resources, please complete our online feedback form.

Thank You

Links to Additional Resources

Environmental Dredging Control Measures and Management B-58