Managing Sediments in the Watershed:

Bringing Dredged Material and Watershed Managers Together

Using Contaminated Sediments Beneficially

Richard A. Price
Environmental Laboratory
richard.a.price@erdc.usace.army.mil

Engineer Research and Development Center

Dredged Material
What is it?

- Toxic sludge?
- Toxic waste?
- Spoil?
- Solid waste?
- **Displaced soil & sediment**

Sources of contamination

What do we do with it?

- Open-water placement
- Near-shore placement
  - Islands, wetlands, beach
- Upland placement
  - CDF, landfill
- Beneficial Uses
  - Key to sustainable space

Beneficial Uses of Dredged Material

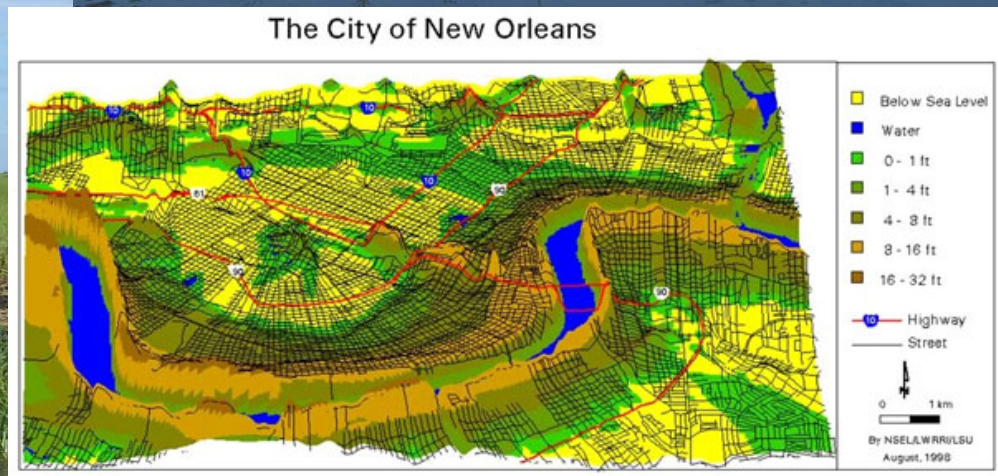

Dike 10B,
Cleveland

Construction Materials


870 KG/HA

PLAY Metropolitan Golf Links

Wetland Creation, LA



Island Habitat

Mineland Reclamation

Dredged Material Recycling

Dredged Material to Landscapes

Grand Haven Schools, MI

What is the Need/Problem?

- Need to reclaim CDF capacity
  - Sand/gravel – construction fill/feedstock
    - not enough demand in area of disposal
    - logistics
  - Fine grained - topsoil type uses
    - concerns and uncertainty dealing with contaminated material

Define Contaminated?

- Rendered impure
- Rendered harmful (unsuitable)

Define Clean Sediment?

- Zero (undetectable) metals, organics, etc
- Causes no adverse effects (suitable)

Testing Requirements for DM Placement Suitability

- **MPRSA Exclusions (40 CFR 227.13)**
  - Primarily sand, gravel, rock **&** in high current/wave energy
  - For beach nourishment & primarily sand, gravel, or shell, with particle sizes compatible with the receiving beach
  - Same as disposal substrate, **&** sediments are far removed from known historical sources of pollution
- **CWA Exclusions (40 CFR 230.60)**
  - Material not a carrier of contaminants (course grained/high energy)
  - Sufficiently far removed (pre-industrialized or mineral sources)
  - Adjacent to (discharge and excavation sites are the same)
  - Constraints available (reduce to acceptable levels, no transport form disposal site)

Testing Guidance for Environmental Suitability

- **Evaluation of Dredged Material Proposed for Ocean Disposal (Ocean Testing Manual)**
  - Marine Protection, Research and Sanctuaries Act (1972)
  - Pass/fail testing for suitability
- **Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual (Inland Testing Manual)**
  - Section 404 CWA (1977)
  - Pass/fail testing for suitability
- **Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual (Upland Testing Manual)**
  - NEPA and CWA
  - Testing to evaluate potential impacts and implement controls

Contaminant Pathways

- Aquatic and terrestrial animal exposure
- Wetland and upland plant exposure
- Water
  - Turbidity
  - Effluent discharge
  - Rainfall runoff
  - Leachate to groundwater
- Air
  - Volatile emissions
  - Dusts

Testing Guidance and Application to Beneficial Use

Ocean Testing Manual (Ocean open-water)

- MPRSA Exclusions (40 CFR 227.13)
- Contaminant pathways
  - Water
    - Water quality criteria
  - Animal
    - Water column toxicity
    - Benthic Bioaccumulation

Generally, if suitable for disposal - suitable for beneficial use

Testing Guidance and Application to Beneficial Use

Inland Testing Manual (Open-water including wetlands)

- CWA Exclusions (40 CFR 230.60)
- Contaminant pathways
  - Water
    - Water quality criteria (water column, effluent, surface water)
  - Animal
    - Water column toxicity
    - Benthic Bioaccumulation

Generally, if suitable for disposal - suitable for beneficial use

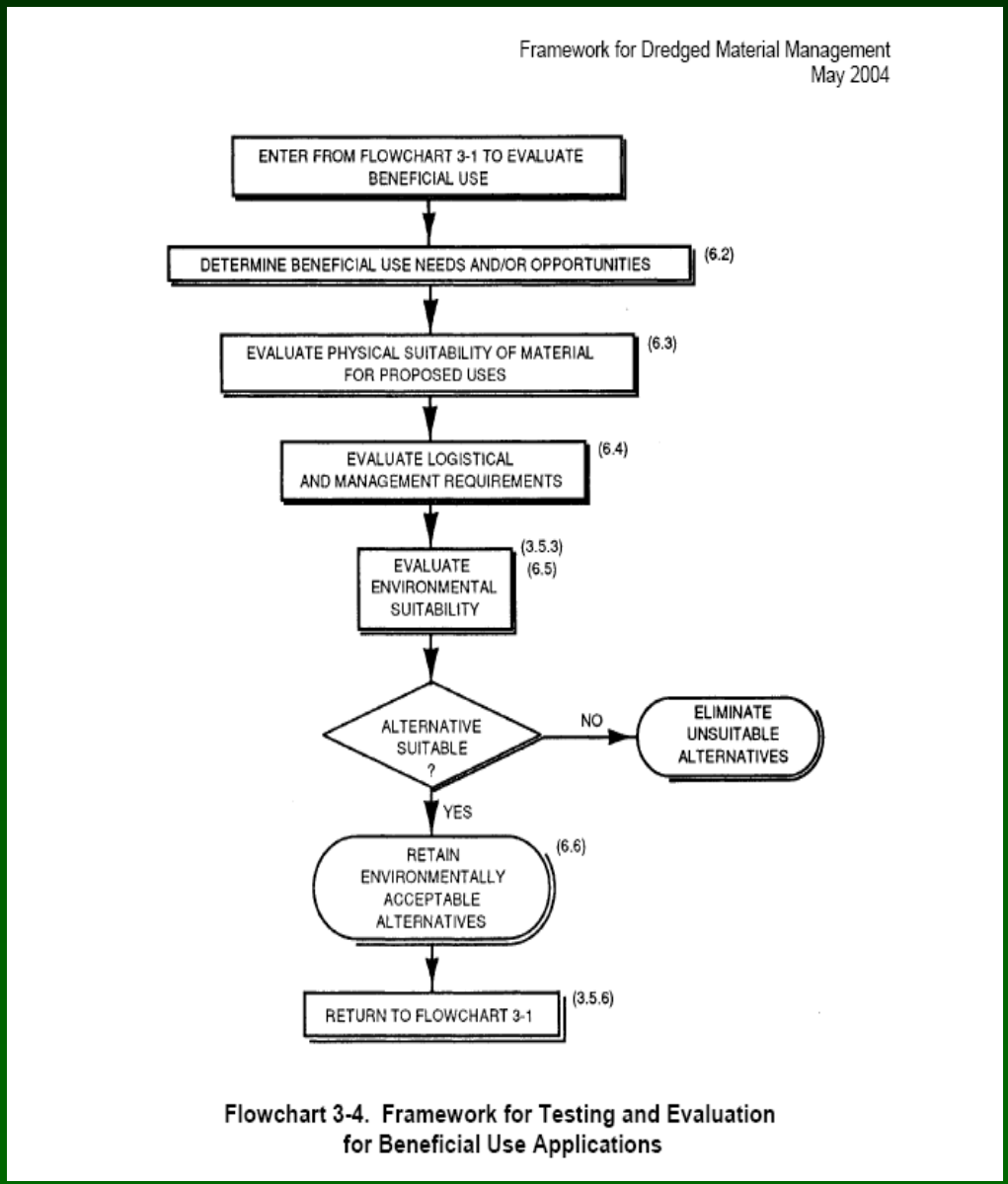
Testing Guidance and Application to Beneficial Use

Upland Testing Manual (Upland and wetland CDFs)

- Contaminant pathways
  - Water
    - Water quality criteria (water column, effluent, surface runoff, leachate)
  - Plant
    - Saltwater and freshwater wetland toxicity and bioaccumulation
    - Upland toxicity and bioaccumulation
  - Animal
    - Water column toxicity
    - Benthic bioaccumulation
    - Soil invertebrate toxicity and bioaccumulation
  - Air
    - Volatile emissions
    - Dust – no test specified

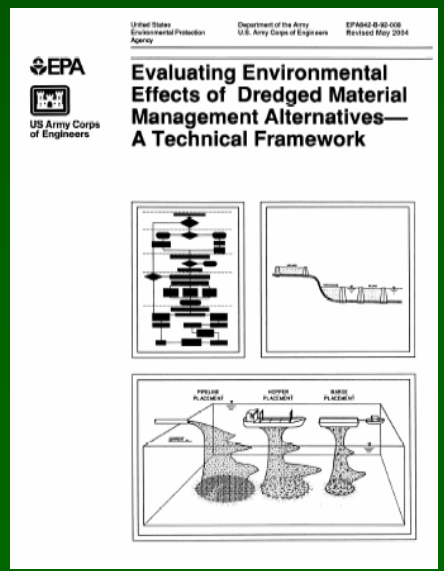
The UTM is not designed to address suitability for beneficial use. However, the approach and procedures may be used for such evaluations in conjunction with other frameworks.

Evaluating Environmental Effects of Dredged Material Management Alternatives – A Technical Framework (EPA842-B-92-008)

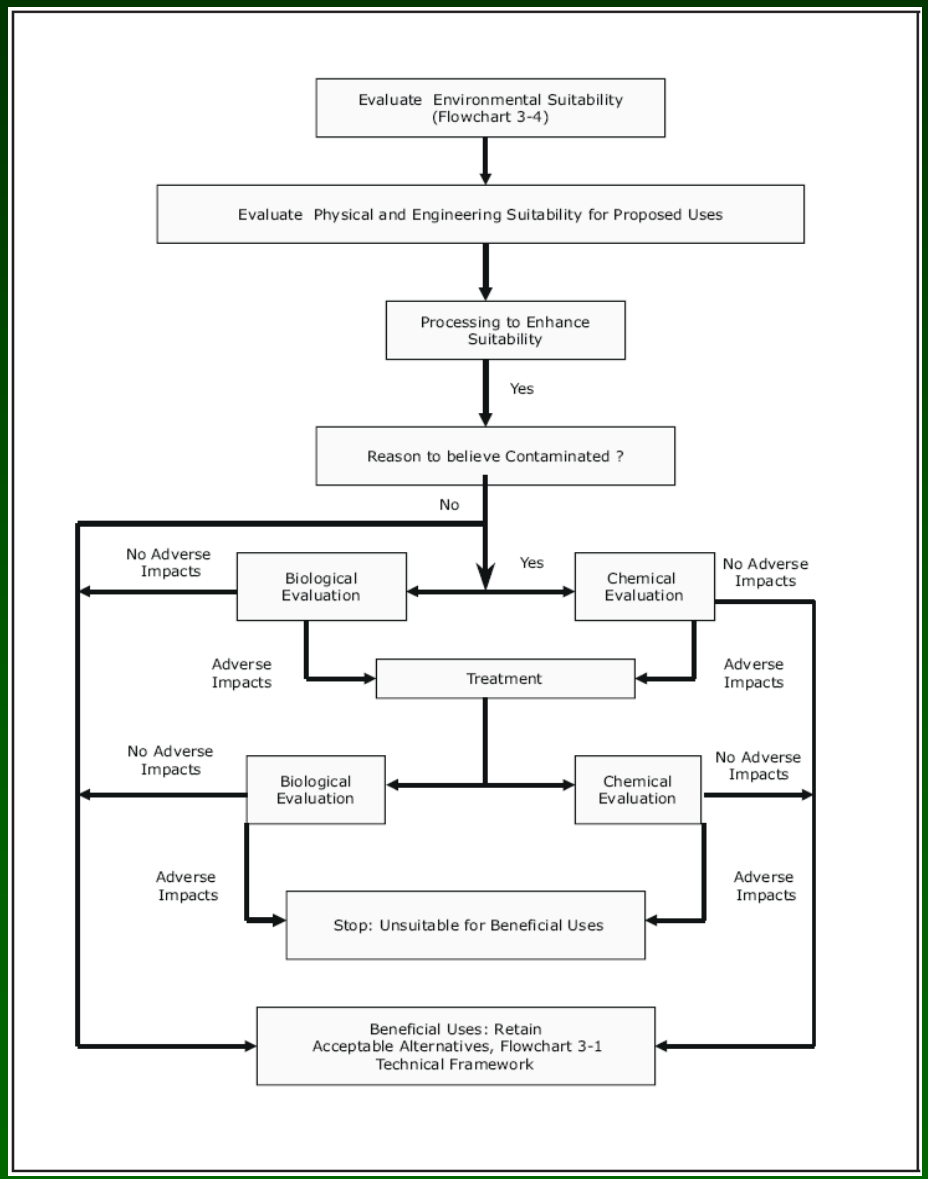


Flowchart 3-4. Framework for Testing and Evaluation for Beneficial Use Applications

- BU opportunities
- Physical suitability
- Logistics & Mgt needs
- Evaluate environmental suitability – no testing methods specified
  - State/Fed screening criteria
  - Physical & biological tests
  - No treatment alternatives considered



Proposed Testing Framework



- Meet physical and engineering characteristics?
- Process to enhance characteristics?
- Reason to believe contaminated?
- Fail chemical and/or biological testing? –Compare to reference
- Can treatment reduce contaminant impacts?
- Risk assessment for specified use

Beneficial Use from CDFs Issues to be Addressed

- Material assumed not suitable for open water disposal
  - Assumed to be contaminated
- Material from mixed dredging projects
  - Sampling and characterization – segregate, blend?
- Testing and evaluation procedures are not established
  - State regulatory criteria are too restrictive

Defining Contaminant Status

- Contaminated - State regulatory guidance for reuse.
  - State criteria, cleanup levels, Eco-SSLs, etc.
- Exposure effects - Contaminant pathways.
  - Effects on water quality (solubility) - WQS
  - Bioavailability to plants and animals –
  - Tissue concentrations - No standards (Compare to reference or background tissue or define potential risks – State/local decision)
- Treatment Options - Material may be treated to meet regulatory compliance.
  - Phytoremediation, bioremediation, chemoremediation, etc.
- Adverse impacts - Restricted uses.
  - Exposure/effects response, risk assessment

Comparison of State Criteria for Beneficial Use of Dredged Material

Beach Nourishment

Contaminant	IL[a]	IN[b]	MI	MN[c]	NY[d]	OH	PA	WI[e]
Arsenic	*0.05**	*3.9*	Must be >95% sand	*12*	*7.5*			Grain size and color requirements
Lead	*0.0075**	*81*		*400*	*Background*			
Zinc	*7,500*	*10000*		*1,242***	*20*			
PCBs	*1*	*1.8*		*1.2***	*1*			
Benzo(a)pyrene	*0.09*	*0.5*		*1.0***	*0.061*			
Benzene	*0.03*	*0.034*		*0.034***	*0.06*			
Criteria Source	Cleanup – Residential	Cleanup – Residential	Use-specific regulation	Cleanup – recreational	Cleanup – General			Use-specific regulation

All units are in milligrams per kilogram (mg/Kg) of material except * in milligrams per liter (mg/L) of leachate.

a: Illinois values are based on the most restrictive exposure route for that contaminant from the TACO Tier 1 residential tables.[73] For ionizable contaminants, a soil pH of 7.0 is assumed for the groundwater ingestion route.

b: Indiana values are based on the RISC tables for an residential soil.[74]

c: Minnesota criteria are based on SRV Tier 2 chronic recreational standards,[96] except for **, which are from SLV Tier 1 standards.[194]

d: New York criteria are based on Department of Environmental Remediation Technical and Administrative Guidance Memorandum 4046: Determination of Soil Cleanup Objectives and Cleanup Levels.[98]

e: The Wisconsin code lists only two explicit criteria, grain size and color. Risk to beach users is addressed qualitatively by limits placed on the source of beach nourishment material. Grain size is limited by requiring the P200 fraction to be no more than 15% of the average fines content (silt and clay, or P200 fraction) of the native beach material. Color is required to be a close match to existing beach soil color.

Comparison of State Criteria for Beneficial Use of Dredged Material

Compost or Topsoil, Unrestricted Use

Contaminant	IL[a]	IN[b]	MI[c]	MN[d]	NY[e]	OH[f]	PA	WI[g]
Arsenic	*0.05**	*3.9*	7.6	*10*	7.5	*41*		*0.042*
Lead	*0.0075**	*81*	400	*400*	Background	*300*		*50*
Zinc	*7,500*	*10000*	65	*1,242***	Background	*2,800*		*4,700*
PCBs	*1*	*1.8*	1.2	*1.2*	*1.0*	--		--
Benzo(a)pyrene	*0.09*	*0.5*	2	*1.0***	*0.061*	--		*0.0088*
Benzene	*0.03*	*0.034*	0.1	*0.034***	*0.06*	--		--
Criteria Source	Cleanup – Residential	Cleanup – Residential	Use-specific regulation	Cleanup – Residential	Specific reuse and general cleanup	Sludge rules		Reuse – General

All units are in milligrams per kilogram (mg/Kg) of material except * in milligrams per liter (mg/L) of leachate.

a: Illinois values are based on the most restrictive exposure route for that contaminant from the TACO Tier 1 residential tables.[73] For ionizable contaminants, a soil pH of 7.0 is assumed for the groundwater ingestion route.

b: Indiana values are based on the RISC tables for a residential soil.[74]

c: Michigan compost criteria are based on draft rules[183] for Part 115.[13]

d: Minnesota criteria are based on SRV Tier 2 chronic residential standards,[96] except for **, which are from SLV Tier 1 standards[194].

e: New York criteria are based on DER TAGM.[98] Background can be a site or regional background, as appropriate. Compost values in 6 NYCRR Part 360-5[16] may apply if the dredged material is used as a limited component.

f: Ohio values are based on monthly average limits contained in Ohio's sewage sludge rules[22]. There are additional limits for a single application and a total lifetime loading limit.

g: Wisconsin criteria are based on NR 538, Appendix 1, Table 1B. These criteria qualify the material as Category 1, allowing its application in nearly all beneficial uses.

Current Beneficial Use Guidance

- Engineer Manual. (1987). “Beneficial uses of dredged material.” Engineer Manual No. 1110-2-5026. Department of the Army, U.S. Army Corps of Engineers, Washington, DC.

- San Francisco Bay Regional Water Quality Control Board. (2000). Draft Staff Report “Beneficial Reuse of dredged Materials: Sediment Screening and Test Guidelines” Sacramento, CA.

- U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. (2004). "Evaluating Environmental Effects of Dredged Material Management Alternatives – A Technical Framework," EPA 842-B-92-008, Washington, DC.

- Beneficial Use Upland Testing and Evaluation Project Management Team. (2004). “Testing and Evaluating Dredged Material for Upland Beneficial Uses: A Regional Framework for the Great Lakes,” 2nd Ed., Great Lakes Commission, Ann Arbor, MI.

- Brandon, Dennis L., and Price, Richard A. 2006 (in-press). “Survey of Available Guidance and Best Practices for Determining the Suitability of Dredged Material for Beneficial Uses,” ERDC/EL TR-05-##, US Army Research and Development Center, Vicksburg, MS.

NDT Recommendations for BU, 2001
Action Agenda for the Next Decade

- National guidance – framework for identifying, planning & financing BU, authorities & processes. (ERDC- Summary of guidance/best practices in press. Will be a living web-based document.)
- National guidance – role of Fed Std in implementing BU from CE new and navigation projects.
- Encourage direct marketing of DM to public agencies/private entities (Section 215 WRDA, 2000). (Proposed Dredged Material Resource Database-ERDC)
- Develop/distribute description of CE streamlined process for continuing authorities on DMM.
- ID sources of tech info/guidance on BU, data gaps – charge agencies to fill gaps. (Guidance on using contaminated material – DOER priority)
- Encourage R&D on BU – Tech transfer on demo projects. (DOER needs $$ support)
- ID specific potential local BU projects/sponsors for near-term/future dredging activities. (ERDC has provided research support for this, DOER/DOTS)
- Improve and advertise the BU website and other info sources. (ERDC is doing this – DOER/DOTS)
- Identify factors needed to track volumes used beneficially – establish system. (Proposed Dredged Material Resource Database-ERDC)

Web Resources

- Dredging Operations Technical Support
  http://el.erdc.usace.army.mil/dots/dots.html
- Beneficial Uses of Dredged Material
  http://el.erdc.usace.army.mil/dots/budm/budm.cfm
- Dredging Operations and Environmental Research Program
  http://el.erdc.usace.army.mil/dots/doer/doer.html

Beneficial Uses of Dredged Material

U.S Army Corps of Engineers | Engineer Research and Development Center | U.S. Environmental Protection Agency

Introduction

Engineered Uses

Environmental Enhancement

Agricultural/ Product Uses

Most dredged material can be a valuable resource and should be considered for beneficial uses. The purpose of this site is to demonstrate potential beneficial uses of dredged material by presenting existing case studies as examples. Category descriptions, procedural outlines, and reference resources are also provided.

This site is a collaborative effort between
U.S. Environmental Protection Agency and U.S. Army Corps of Engineers