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U.S. ARMY

MOVING THE NEEDLE: BENEFICIAL USE OF CONTAMINATED SEDIMENTS IN THE UNITED STATES

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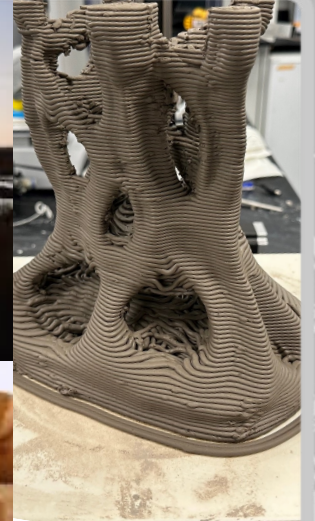
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US Army Corps
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DISCOVER | DEVELOP | DELIVER

Context



- **190 million cubic meters dredged annually from federal navigation channels across the United States.**
- **10-15% of navigational dredge material and virtually all environmental (clean-up) dredge material currently requires special handling and management.**
- **Diminishing capacity for upland management/disposal of contaminated material**
- **Environmental dredging needs are recurring.**
 - **Uncontrolled legacy sources**
 - **Permitted industrial outfalls**
 - **WWTP outfalls**
 - **CSOs**
 - **SWOs**
 - **Commercial maritime operations**
- **The opportunity costs of treating contaminated sediment as a waste are in the billions of US dollars.**

Sustainable Sediment Management



Operating principles for finding sustainable sediment management solutions:

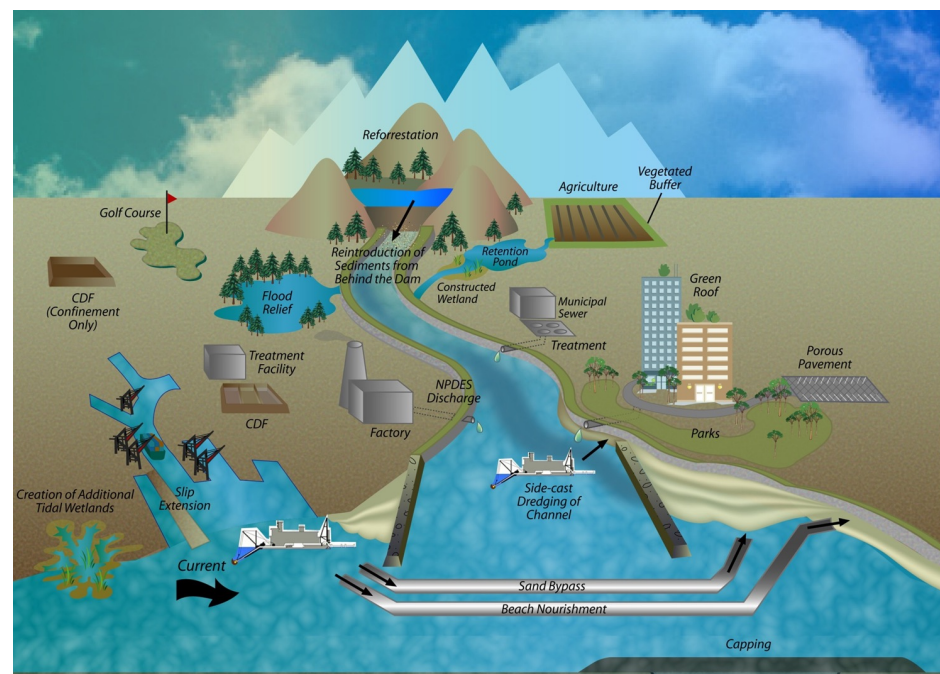
- Recognize sediments as a resource.
 - ▶ Link and leverage across multiple projects and authorities.
 - ▶ Consider regional implications of local sediment actions which benefit the region.
- Improve operational efficiencies by capitalizing on the natural coastal processes.
 - ▶ Evaluate and recommend economically viable and environmentally sustainable solutions.
 - ▶ Enhance technical knowledge and tools for regional approaches.
- Share lessons learned, information, data, tools, and technologies.
- Improve Relationships.
 - ▶ *Communicate and collaborate with stakeholders, partners, sponsors, federal and non-federal agencies, academia, non-governmental organizations*

[Regional Sediment Management \(arctis.com\)](http://arctis.com)

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Beneficial Uses of Dredged Material

- Purposeful, intentional use as a valued resource to provide social, economic and environmental benefits
- Value-added proposition
 - Use treated contaminated sediments as lower-tier fill for:
 - ▶ Habitat development
 - ▶ Parks and recreation
 - ▶ Brownfield development
 - Strip mine reclamation
 - Solid waste landfill (interim) capping
 - Material manufacturing
- Significantly reduces disposal requirements
- Interest at an all-time high
 - USACE Chief of Engineers set a goal of 70% beneficial use by 2030
 - Use of treated, contaminated DM for BU aligns with this goal.



[Implementation Guidance for Section 125\(a\)\(2\)\(C\) of the Water Resources Development Act of 2020, Beneficial Use of Dredged Material 7 November 2022](#)

When are Sediments “Contaminated”?

- All sediments contains traces of the landscapes they passed through prior to being deposited as sediment.
- All sediments pass through landscapes that are altered by people (directly or indirectly).
- All sediments have an anthropogenic fingerprint.
- Contamination gradient



- Concentrations, properties, and “availability” of sediment-associated contaminants determines suitable uses.
 - Unconfined beneficial use
 - Engineered placement for beneficial use
 - Treatment for beneficial use
 - Disposal
- Analogous to how physical sediment characteristics determine suitable uses.

Management

Capping

Los Angeles River Estuary (LARE) Capping Project:

- 100K cubic yards of contaminated material from LARE placed in old borrow pit
- Capped over with 3' clean sand from adjacent area
- Over a decade of monitoring - no contaminant movement
- Not intended as beneficial use but...
 - Subsequent biological surveys showed thriving benthic community in what was formerly an anoxic dead zone due to poor circulation.
 - Simply changing elevation led to significant improvement in habitat.



Engineered Fill

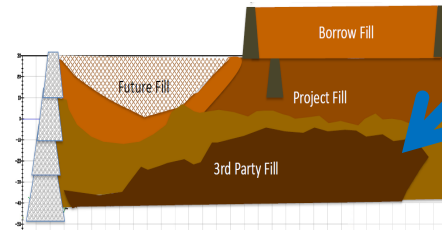
Port of Long Beach – Middle Harbor Project

- Contaminated sediments from other projects in the region meeting pre-specified criteria:

 - Contaminant Levels
 - Geotechnical Characteristics
 - Schedule



- Required approx. 4,000,000 cy of fill material
- 1,900,000 cy generated from Middle Harbor Projects
 - 900,000 cy from 3rd party material
 - 400,000 cy from other Port and outside projects
 - 800,000 cy from approved borrow locations within the project site



Treatment

- **Physical Treatment Processes**
 - *Soil Washing/Particle Sorting Technologies*
 - *Solidification*
- **Chemical Treatment Processes**
 - *Extraction/stabilization*
 - *Chelation*
 - *Chemical reduction/oxidation*
- **Thermal Treatment Processes**
 - *Vitrification*
 - *Thermal Desorption*
- **Biological Treatment Processes**
 - *Composting*
 - *Land Farming*
 - *Phytoremediation*
 - *Fungal Remediation*

Physical - Particle separation



Thermal – Rotary kiln



Physical/Chemical – Soil Washing



Biological – Myco (Fungal) remediation



Expands potential opportunities for beneficial use

Technical & Legal/Regulatory Challenges...

- **Multiple Authorities (Corps – Navigation and Flood Control, EPA and States – Inputs and beneficial use designations,)**
- **Multiple Jurisdictions (Federal, State, County, Cities).**
- **Lack of clear regulatory guidance**
- **Competing uses/users (navigation, flood control, water storage, waste discharge, recreation, other ecosystem goods and services....)**
- **Perceptions (dumping/disposal, spoil, contamination)**
- **Uncertainty dealing with contaminants**
- **Emerging contaminants, e.g., microplastics, HABs, PFAS**
- **Concept of “adaptive management” is not widely accepted/understood**
- **Liability (Perceived vs Actual)**
- **Market demand/displacement for treated materials**

Moving the Needle



- **Understanding where we are now?**
- **Identifying Technical & Regulatory Challenges**
- **Improved Accounting (Ecosystem Services)**
- **Establishing RDT&E pipeline for development and transitioning of new technology**
- **Two White Papers**
 - **Beneficial Use of Contaminated Sediments**
 - **Sediment Treatability Technology**
- **Workshop in the Spring of 2024**
- **OMB guidance for ES in Cost Benefit Analysis (August 2023)**
- **Public Private Partnership for RDT&E FY23**

Where are we now?

Beneficial Use of Contaminated Sediments – A White Paper

By - Barr Engineering Co., Deltares, & Windward Environmental LLC

Key observations based on the literature:

- Sediment increasingly is seen as a resource, not a waste
- Treatment or pre-treatment facilitates/expands beneficial use options
- Beneficial use of contaminated material more common in upland settings than aquatic
- End use affects both risk and risk acceptability
- Regional sediment management/planning facilitates programmatic approaches to beneficial use
- Techniques and applications are advancing
- Beneficial use aligns with sustainability principles
- Sustainability evaluations are becoming more common
- Approaching management options through sustainability evaluation creates opportunities
- Calculating lifecycle costs facilitates beneficial use
- Stakeholders may draw valid but contradictory conclusions regarding acceptability
- Improved communication/engagement can reduce stigma
- Regulatory flexibility to allow adaptive management (to control risks and enhance rewards over time) is foundational to achieving the social, economic and environmental benefits of beneficial use
- Questioning conservative biases in screening-level risk assessments will enable risk characterization and management decisions that provide greater social, economic, and environmental benefits.

Where are we now?

The State of Treatment Technologies – A White Paper – by Integral Consulting

Current R&D study, in progress –

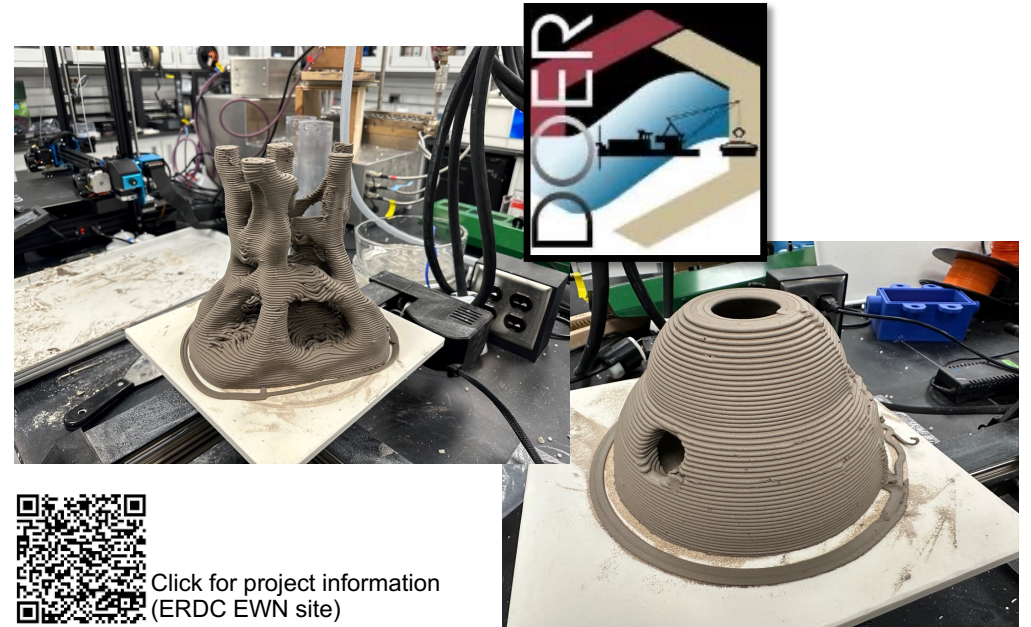
- 2,937 sources reviewed; 85 references selected
- **State of the Science on Treatment Technologies**
 - Solidification/Stabilization
 - Biological
 - Extraction
 - Hybrid
- **Factors Warranting Consideration during selection**
 - Treatment Technologies
 - Beneficial use applications
- **Risks associated with Treatment Technologies and Beneficial Use**
- **Summary and Recommendations**
- **Appendix – Case Studies**

Public Private Partnership for Advancing RDT&E

- **Funded by Congress in FY24 (\$2M, with a private sector match)**
- **Four Projects selected:**
 - **Applied Research and Field Demonstration Testing of Contaminated Sediment Beneficial Use at Two Regional Sites (Anchor QEA & UMBC)**
 - **Laboratory scale evaluation of combining advanced oxidation process with sediment stabilization for beneficial use in construction (TTU)**
 - **Development & Application of LC Cost Benefit Analysis to establish BU opportunities for CDF sediments (Ramboll)**
 - **Sediment Bacteria Mining for Endophyte Inoculation and Phytoremediation for Beneficial Use (AECOM)**

Other USACE Research

- **Sequestering Dredged Material Contaminants for Nearshore Beneficial Use Applications in 3D Printed Structures – DOER RT24-07**
- **In Situ Beneficial Use of Contaminated Sediments: Leveraging Dredged Sediment for Enhancing Aquatic Habitats and other Benefits - DOER RT24-09**



Click for project information
(ERDC EWN site)

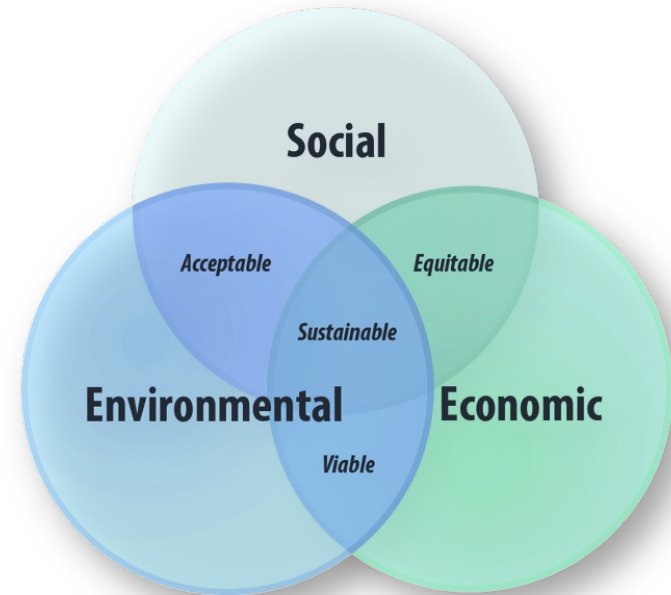
3D Printed Habitat Structures



Rendering of Habitat Uplift Using Contam. Seds.

Next Steps

- **Kick-off FY24 PPP Projects**
- **Formalize Governance & Strategy for PPP**
- **Technical Workshop Spring 2024 (To identify and prioritize technical and reg./policy needs)**
- **Set Priorities for selection of FY25 PPP Projects (assuming funded)**



...efficient investment of resources to create present and future value.

Questions?

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