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Disposal of Confined Dredged Material

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Module 1: Introduction

Learning Objectives

By the end of this section, you will be able to:

- **Identify** the core regulatory authorities and engineering references governing the design and management of confined disposal facilities.
- **Evaluate** the primary technical objectives of containment area design, specifically regarding solids retention and storage capacity.
- **Explain** the physical behavior of coarse-grained versus fine-grained sediments during hydraulic transport and deposition.

Executive Summary: Confined disposal facilities are engineered structures critical to the U.S. Army Corps of Engineers' mission, handling approximately 90 million cubic yards of maintenance material annually. Successful design requires balancing short-term effluent quality (solids retention) with long-term storage capacity through active management of sedimentation, consolidation, and dewatering processes.

Design and Management Purpose

The primary objective of this manual is to provide professional guidance for the **planning, design, construction, operation, and management** of confined dredged material disposal areas (also referred to as containment areas or confined disposal facilities). These structures must perform two critical functions:

- **Retention of suspended solids** during active hydraulic disposal operations.
- **Provision of adequate storage volume** for both immediate (short-term) and project-life (long-term) requirements.

Scope of Applicability

These standards apply to all field operating activities involved in the administration and execution of dredging programs. While the manual focuses on technical design, it also addresses the necessity of ensuring these sites are compatible with **future land-use goals** and **environmental protection** mandates.

Engineering References

Personnel involved in the lifecycle of containment areas should be familiar with the following regulatory and technical documents:

- **ER 200-2-2:** Environmental Quality Procedures
- **ER 1105-2-10/20/50:** Planning Guidance and Policies
- **EM 1110-2-1902:** Slope Stability
- **EM 1110-2-1906:** Laboratory Soils Testing
- **EM 1110-2-5025:** Dredging and Dredged Material Disposal (General Overview)
- **Hydraulics Design Criteria Sheets 224-1/2 to 224-1/4**



Engineering Background and Magnitude

The U.S. Army Corps of Engineers (CE) manages approximately **300 million cubic yards** of maintenance dredging and **100 million cubic yards** of new work annually.

Annual Distribution of Maintenance Material

- **Total Maintenance Volume:** ~300 million cubic yards
- **Confined Disposal Volume:** ~90 million cubic yards (30%)
- **Primary Locations:** Major ports along the Atlantic and Gulf coasts and Great Lakes harbors.

Design and Operational Scope

Confined disposal sites are not merely storage pits; they are **engineered structures** that must be modeled for specific performance criteria.

Key Technical Components:

- **Sedimentation Design:** Utilizing column tests to define flocculent, zone, and compression settling behavior, primarily for fine-grained materials.
- **Effluent Quality Control:** Implementation of **chemical clarification systems** and **weir design** (length and location) to meet water quality certifications regarding turbidity and suspended solids.
- **Storage Capacity Management:** Evaluating the long-term consolidation of both the dredged material and the underlying foundation soils.
- **Automated Tools:** Many procedures within this manual are integrated into the **Automated Dredging and Disposal Alternatives Management System (ADDAMS)**.

⚠ Safety Constraint: In cases where the disposal site is owned by a third party or project sponsor, the authority to implement management practices under Section 148 of PL 94-587 may be limited. Always verify site ownership and current policy on a case-by-case basis before finalizing management plans.

Confined Disposal Considerations

The design of a diked containment area must account for the hydraulic behavior of the slurry and the physical characteristics of the sediment.

Sediment Separation during Inflow

- **Coarse-Grained Material (>No. 200 sieve):** Rapidly falls out of suspension near the inlet pipe, typically forming a mound.
- **Fine-Grained Material (<No. 200 sieve):** Flows through the containment area, requiring specific ponding depths and retention times to settle before reaching the weir.

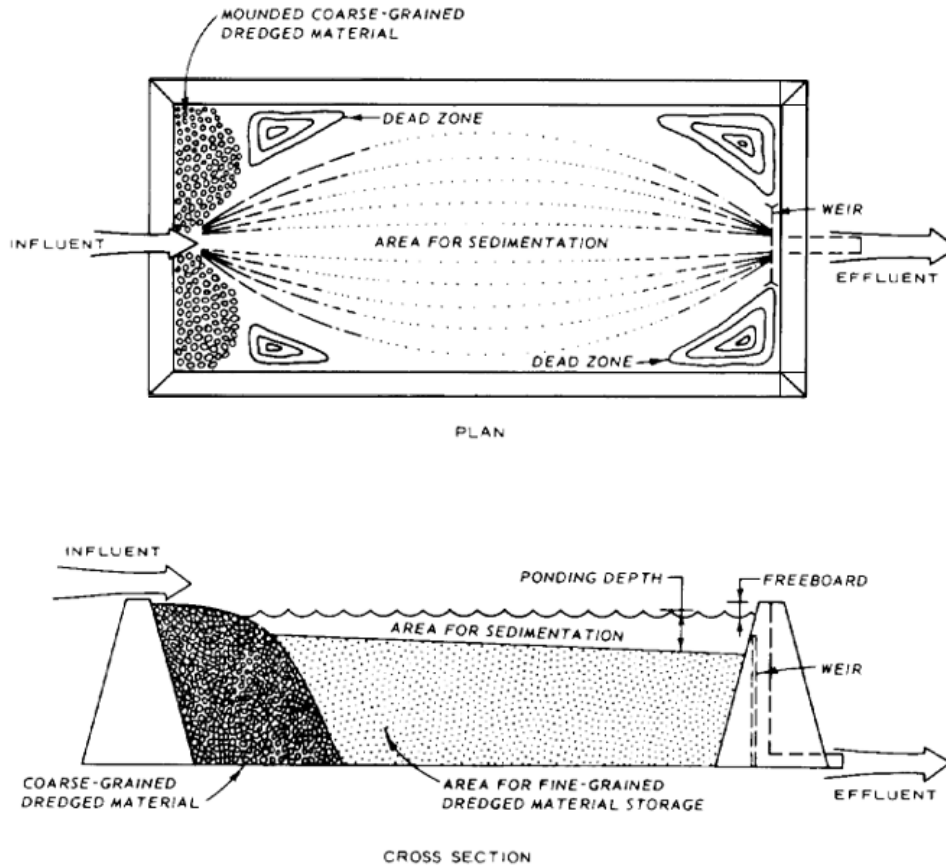


Figure 1-1. Conceptual diagram of a dredged material containment area

Hydraulic Management

- **Weir Operation:** Effluent flow rate generally equals the influent flow rate during continuous operation. Weirs control the **static head** and **ponding depth**.
- **Effective Surface Area:** Note that "dead spots" in corners and mounding of coarse material often make the **effective surface area** significantly smaller than the total enclosed area.

💡 **Design Tip:** To maximize the storage life of a facility, implement active dewatering techniques such as natural drying and trenching immediately after the decanting phase. This promotes consolidation and creates capacity for future cycles.

📊 **Calculation Note:** When determining storage volume, account for both the volume of the solids and the volume of water retained within the voids of the settled material, as well as the anticipated settlement of the foundation.



Checkpoint Quiz

1. Which material type typically forms a "mound" immediately adjacent to the dredge inlet pipe?

- a) Silt (<No. 200 sieve)
- b) Organic clay
- c) Coarse-grained material (>No. 200 sieve)
- d) Flocculated slurry

Answer: (c). Coarse material falls out of suspension rapidly due to higher settling velocities, whereas fine material requires the full length of the ponded area to settle.

2. What is the primary purpose of managing the weir crest elevation during disposal operations?

- a) To increase the velocity of the influent
- b) To maintain adequate ponding depth for sedimentation
- c) To prevent consolidation of foundation soils
- d) To increase the static head of the pump

Answer: (b). Maintaining ponding depth is critical to providing the retention time necessary for fine-grained solids to settle before water is discharged.

3. Under PL 94-587, Section 148, what is the Secretary of the Army's mandate regarding disposal areas?

- a) To phase out all diked disposal by 2030
- b) To utilize management practices that extend the capacity and useful life of existing areas
- c) To prioritize aquatic disposal over land-based containment
- d) To ensure all dikes are constructed using recycled concrete

Answer: (b). The law explicitly encourages practices like dewatering and consolidation to minimize the need for new disposal sites.

Module 2: Field Investigations

Learning Objectives

By the end of this section, you will be able to:

- **Select** appropriate sampling equipment based on sediment texture and required penetration depth.
- **Identify** the necessary laboratory sample quantities and preservation methods for sediment characterization and settling tests.
- **Evaluate** site-specific characteristics and stratigraphic data to minimize adverse impacts on underlying groundwater.

Executive Summary: Accurate containment area design depends on comprehensive field data. Investigations must characterize channel sediments for dredging volumes and settling behavior while simultaneously evaluating the containment site's foundation stability and potential groundwater impacts. Strategic site selection and robust sampling protocols are the primary defenses against long-term storage failure and environmental contamination.

Design Fundamentals

Field investigations are the backbone of containment area design. They provide the empirical data required for:

- **Volume Determination:** Surveying the channel to establish dredging requirements.
- **Laboratory Testing:** Sampling sediments to define settling and consolidation behavior.
- **Foundation Evaluation:** Defining dike stability and predicting long-term foundation settlement.

⚠ Safety Constraint: Evaluate the potential presence of contaminants during the planning phase and implement appropriate safety measures for field crews.

Channel Sediment Investigations

The level of effort for sampling is highly project-dependent. While routine maintenance may rely on historical data, new work requires extensive investigation.

Sample Type and Location

- **Maintenance Projects:** Grab samples are typically sufficient for characterization as bottom sediments are generally unconsolidated.
- **New Work Projects:** Conventional borings are required to define stratification and dredging difficulty to the full anticipated depth.
- **Spatial Variation:** If segregated pockets of coarse and fine-grained material exist, take samples at enough locations to define spatial variations.
- **Salinity:** Take water samples near the sediment-water interface to determine if the environment is freshwater or saltwater.



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