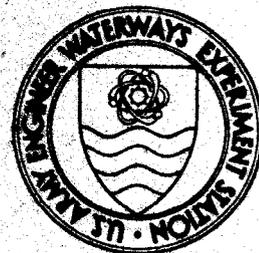


DREDGED MATERIAL RESEARCH PROGRAM



CONTRACT REPORT D-74-8

ASSESSMENT OF THE FACTORS CONTROLLING THE LONG-TERM FATE OF DREDGED MATERIAL DEPOSITED IN UNCONFINED SUBAQUEOUS DISPOSAL AREAS

by

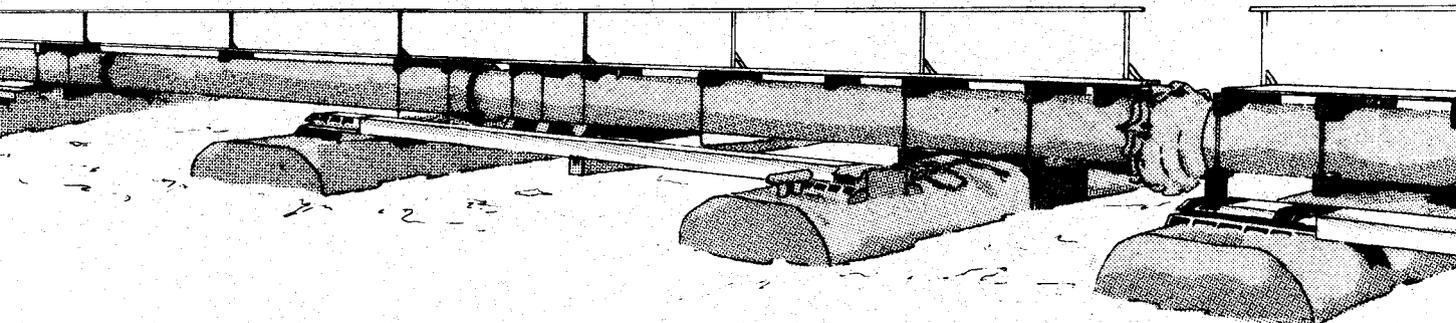
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Prepared for Environmental Effects Laboratory
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IN REPLY REFER TO: WESYV

28 February 1975

SUBJECT: Transmittal of Contract Report D-74-8

TO: All Report Recipients

1. The contract report transmitted herewith represents the results of one of six efforts (work units) initiated to date as part of Task 1B (Movements of Dredged Material) of the Corps of Engineers' Dredged Material Research Program (DMRP). Task 1B is included under the Aquatic Disposal Research Project, which is concerned with the environmental effects of open-water disposal of dredged material as well as the spatial and temporal distributions of dredged material discharged into various hydrologic regimes.
2. In order to evaluate the environmental impact of open-water disposal, whether it be in a river, lake, bay, or ocean or from a barge, hopper dredge, or pipeline dredge, it is necessary to understand and to be able to predict how the dredged material will disperse. This includes the initial dispersal as the material settles through the water column (short-term fate) as well as later dispersal of material from the site as a result of resuspension, transport, and ultimate disposition (long-term fate).
3. Before developing conceptual or mathematical models for prediction, it is necessary to have a working knowledge of previous applicable research on dredged material/sediment movement in the aqueous environment. Moreover, the principles and methodologies must be critically evaluated and the research analyzed to determine what research should be initiated to describe adequately the physical transport mechanisms.
4. The investigation reported herein addressed itself to identifying and evaluating those factors affecting the long-term fate of dredged material deposited in unconfined, subaqueous disposal areas. This contracted effort, accomplished during a six-month period, was nationwide in scale and involved researching literature representing all categories of sponsorship from Federal to local.
5. It was found that the factors that affect the movement of dredged material are identical with those influencing natural sediments and

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include such important long-term factors as bottom-layer mudflows, re-suspension by wind-generated waves, transport by tidal currents, salinity-induced flocculation, Coriolis force, depth stratification, upwelling, local boundary effects, and flood flow rates.

6. Four integrated systems were considered to be applicable to basic research of the dispersion of unconfined dredged material deposited in open water. Each method was determined to have limitations with regard to application to the problem at hand and all methods must be employed in a research program to determine generalized expressions for ultimate use in predicting the fate of dredged material.

7. The study concluded that considerable research, both applied and basic, needs to be undertaken in the field of sediment transport, especially with regard to cohesive, fine-grained material. The general research needs were ranked as high, intermediate, or low priority, and specific research needs were established on this basis. This categorization of needs is being used to guide the further planning of research under Task 1B.



G. H. HILT
Colonel, Corps of Engineers
Director

20. ABSTRACT (Continued)

factors that affect the long-term fate of dredged material deposited in unconfined, subaqueous disposal areas. These fundamental factors are thoroughly discussed in the report. In addition, the present knowledge of various methods and their limitations for determining dredged material dispersion were reviewed. The primary conclusions reached were: (a) Analytical methods do not exist which permit the computation of quantities and rates of spread of finite volumes of dredged material in a flow field. (b) Knowledge of incipient sediment motion is of restricted value since quantities and rates are of direct interest to determine material spread. (c) Previous field experiments failed to adequately monitor the environment during the test, hence were of little value to draw conclusions or generalizations. (d) Future field investigations must employ continuous recording instruments to measure all environmental factors of interest—particularly during storm periods. (e) Hydraulic model studies and laboratory investigations using flumes, wave tanks, etc., are greatly influenced by scaling effects which result from inability to exactly scale the sediments and the environmental factors affecting erosion, transport, and deposition. (f) Because each investigative method (field, laboratory, and analytical) has some limitations, all methods must be employed in a research program to determine generalized expressions for ultimate use in predicting the spread of dredged material. A number of recommendations for priority research to meet the goals of the Dredged Material Research Program were also presented. The major recommendations were to: (a) Conduct field investigations under variable dredging conditions to develop means for predicting percentages of dredged material in various modes (mound, mudflow, and turbidity cloud) from samples of material to be dredged. (b) Study general dispersion patterns of dredged material by currents, waves, and combinations, in laboratory flumes and develop empirical equations for prediction purposes. This must be done for mounds and for bottom mudflows. (c) Conduct combined field, hydraulic model, and mathematical model studies of dredged material dispersion and attempt to generalize results. Use regions where results are applicable to generalization. Use maintenance, noncohesive materials where possibility for mudflow does not exist. Repeat for cohesive materials where mudflows exist. (d) Routinely include geotechnical analyses and bottom surveys of disposal areas in the Corps dredging program. Other, lower priority topics were also recommended and a complete list of possible research topics was included for review. No general policies for the United States were deemed possible due to the wide variety of soils, environments, and water bodies considered. However, regional similarities suggest that some limited generalizations are possible. This report is also recommended as a guide for Corps of Engineers District offices which are planning studies of dredged material dispersion in their areas.