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# THE UNITED STATES ARMY CORPS OF ENGINEERS' PERSPECTIVE ON ENVIRONMENTAL DREDGING*

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## I. INTRODUCTION

Traditionally, there has been public and regulatory agency concern over contaminated sediments which must be dredged by the U.S. Army Corps of Engineers (USACE) to fulfill its navigation mission.[1] Recently, concern over contaminated sediments has heightened, and the problem of in-place contaminated sediments and their potential environmental effect has led to a renewed interest in the removal of these sediments. Because of its navigation mission, the USACE has developed significant technical expertise in dredging and disposal of contaminated sediments. In addition, the USACE, as the nation's dredging agency, has provided support to the Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA) and other agencies which have a direct role in the cleanup of contaminated sediments. With passage of the Water Resources Development Act of 1990,[2] the USACE has been given limited authority related to "environmental dredging"[3] and broader missions with respect to environmental

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1. The Secretary of the Army, acting through the Chief of the Corps of Engineers, has the power to govern transportation and dumping of dredging into navigable waters and control management practices to extend the useful life of dredge material disposal areas. 33 U.S.C. §§ 419-419(a) (1988).

2. Water Resources Development Act of 1990, Pub. L. No. 101-640, 104 Stat. 4604.

3. Water Resources Development Act § 312, 104 Stat. at 4639.

protection.[4] This paper presents an overview of USACE technical expertise in the areas of dredging and disposal of contaminated sediments and existing USACE authorities pertaining to environmental dredging.

## II. THE PROBLEM OF CONTAMINATED SEDIMENTS

### A. *Background*

Sediments in many of the nation's harbors and waterways have become polluted because of municipal and industrial discharges and non-point sources.[5] Sediments act as a sink for many contaminants, and sediment contamination of some waterways contributes to environmental degradation and regional environmental problems. Sediment contamination may extend over a large portion of a harbor, waterway or estuary. In a recent report by the National Research Council Marine Board, contaminated sediments were described as a "pervasive and widespread . . . problem" of "national importance".[6] The report concluded that these sediments posed a potential threat to marine resources and human health.[7] It was estimated by the EPA and NOAA that hundreds of aquatic sites had sediments contaminated at levels that were of concern to environmental scientists and managers.[8]

With controls on point-source contamination and management authority over non-point sources put in place, input of additional contaminants to U.S. waterways has been reduced. Consequently, in some areas, existing contaminated sediments are now considered a major source of toxic chemicals that may have a negative impact on the

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4. *See* Water Resources Development Act § 306, 104 Stat. at 4635.

5. Examples of non-point sources are urban runoff, contaminated sediments, agricultural runoff, and mine tailings. WILLIAM ASHWORTH, THE LATE, GREAT LAKES: AN ENVIRONMENTAL HISTORY 180 (1986); Salvatore Pagano, *New Era for Water Quality: The Focus Moves from Control of Pollution to its Prevention*, WASTE MANAGEMENT RESEARCH REPORT 14 (1992).

Traditionally, the focus has been on regulation of discharges from point sources. *See* Federal Water Pollution Control Act, 33 U.S.C. §§ 1251-1387 (1988) (also known as the Clean Water Act). However, Congress recognized the importance of addressing and establishing programs for the control of non-point source pollution. The Clean Water Act requires states to implement non-point source management programs, which were approved by most states in 1990. 33 U.S.C. § 1329.

6. MARINE BOARD, NATIONAL RESEARCH COUNCIL, CONTAMINATED MARINE SEDIMENTS: ASSESSMENT AND REMEDIATION AT v (1989).

7. *Id.* at 4-5.

8. *See id.*

aquatic environment, public water supplies or human health. Within this context, contaminated sediments may be defined as those sediments that have been demonstrated to cause an unacceptable adverse effect on human health or the environment.

B. *Sediment Removal*

Sediment removal is one approach being considered in some of the most seriously contaminated areas. For example, cleanup of contaminated sediments is proposed at several Superfund sites.[9] In most cases, the cleanup alternatives under consideration involve dredging for sediment removal prior to treatment or disposal. Dredging for cleanup purposes is increasingly looked upon as a tool in managing contaminated sediments. This process has recently been referred to as "environmental dredging."[10]

1. *Dredging for Navigation and Cleanup.* Navigation has long been a primary USACE mission.[11] In many industrial and urbanized waterways, some of which are considered contaminated, the USACE must dredge, transport and relocate sediments to perform its navigation mission. Therefore, the USACE is viewed as the nation's dredging agency.

The USACE also has a major regulatory role under the Rivers and

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9. The Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. §§ 9601-9675 (1988), commonly known as CERCLA or Superfund, was passed in order to impose liability on either the property owner or the government for the costs of remedial actions where there is an actual or threatened release of hazardous substances into the environment. Specifically, CERCLA defines a "remedy" or "remedial action" as:

> those actions consistent with permanent remedy taken instead of or in addition to removal actions in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health or welfare or the environment. The term includes . . . dredging.

42 U.S.C. § 9601(24) (1988).

10. Water Resources Development Act of 1990, Pub. L. No. 101-640, § 312, 104 Stat. 4604, 4639.

11. The authority and Jurisdiction of USACE pertains to "navigable waters," or those waters which require a permit for work or structures pursuant to the River and Harbors Act of 1899, 33 U.S.C. §§ 402-403 (1988).

Harbors Act,[12] the Federal Water Pollution Control Act,[13] and the Ocean Dumping Act,[14] the three principal laws which regulate dredging and disposal of dredged material.[15] Although only a small percentage of the sediments dredged to maintain navigation on a nationwide basis is contaminated, the problem is severe in certain areas. The technical problems and public perception associated with contaminated sediments affect the entire navigation program. There is also concern that contaminated areas outside the navigation channel contribute to contamination problems within the channel.

2. *Corps Expertise.* Through the direction of Congress, the USACE has developed a significant technical expertise in dredging, dredged material disposal, and management of contaminated sediments to meet the needs of its navigation program. Regulations, policies, and technical guidance prepared and used by the USACE are based on extensive operating experience and result from comprehensive research programs and project specific studies. Significant resources have been invested in research and development on dredged material management. This effort has had significant influence on legislation and regulations concerned with dredged material disposal.

Further USACE capabilities to manage contaminated sediments have been expanded through technical support to other federal and state agencies. The EPA has turned to the Corps of Engineers in the past for direct assistance in the cleanup of contaminated sediments because of its technical expertise in the areas of dredging and dredged material disposal. The USACE has consequently conducted cleanup dredging and related studies for the EPA, NOAA, the Department of the Navy, and other agencies.

### C. *Technical Considerations*

Research efforts and field experience have provided a substantial knowledge base regarding the technical aspects of dredging and management of contaminated sediments. Available options which should be considered for managing contaminated sediments include no action, non-removal, and removal. The no-action option involves simply allowing natural processes to gradually improve conditions. Non-

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12. 33 U.S.C. § 403 (1988).

13. 33 U.S.C. §§ 1251-1387 (1988).

14. Marine Protection, Research and Sanctuaries Act of 1972, 33 U.S.C. § 1413 (1988).

15. *See* 61 AM. JUR. 2D *Pollution Control* §§ 220-243 (1981).

removal options are those which involve restricted use of a contaminated area or treatment or isolation of the contaminated sediments in-place. Removal options are those which involve environmental dredging followed by treatment or disposal of the sediments at another location. If the decision is made to remove the sediments, the environmental dredging operation cannot be considered as a separate activity. The dredging operation and the subsequent disposal and management of the removed sediments must be compatible.

1. *Dredging Contaminated Sediments.* Dredging contaminated sediments for cleanup involves many of the same considerations as dredging for navigation. Guidance for selection of dredging equipment and advantages and limitations of various types of dredges is available. This information is generally applicable in the context of environmental dredging. However, resuspension of sediment and associated release of contaminants and removal precision are key environmental concerns when dealing with contaminated sediments.

Dredges resuspend[16] some sediment during the dredging process. Some contaminants in the dissolved form and some contaminants associated with resuspended particles will be released and transported away from the dredging site. However, the resuspension due to dredging activities is generally a localized process. Resuspension may be caused by the excavation process, barge or hopper overflow, spillage, leakage, spud movement or other contributions directly related to the dredging process. Contribution of resuspended sediment from the prop wash by tenders, barge movement or other activities is highly variable and unpredictable. Because contaminants normally associated with sediments tend to remain tightly bound to fine-grained sediment particles, control of sediment resuspension is a key consideration in control of contaminant release due to dredging.

2. *Removal Precision.* Removal precision refers to how accurately a given dredge can remove desired areas and thicknesses of contaminated sediment. Precision is important from the standpoint of removing the contaminated material layers while leaving behind as little residual contamination as possible. Also, precision is critical from the standpoint of not removing excessive amounts of clean sediment, as any sediments removed would likely be treated as contaminated material with the associated high cost of disposal and management. Research

16. Dredging stirs up the sediment and causes some pollutants which were absorbed by the sediment to mix with the water again, resuspending them and thus increasing the toxicity of the water. JOHN B. HERBICH, COASTAL AND DEEP OCEAN DREDGING 524-29 (1975).

supplemented by field demonstrations has resulted in general guidance for selection of equipment and techniques for dredging contaminated sediments. Much can be done to limit sediment resuspension from conventional dredges without substantial impact upon the efficiency of the dredging operation. Precautions in operation and/or minor plant modifications can be made with only a small increase in cost. In general, pipeline cutterhead dredges and hopper dredges without overflow generate less resuspended sediment than clamshell dredges or hopper dredges with overflow. It should be recognized, however, that other factors such as maneuverability requirements, hydrodynamic conditions, and location of the disposal site may dictate the type of dredge that must be used. The strategy then must be to minimize the resuspension levels generated by any specific dredge type. If conventional dredges are unacceptable, a special purpose dredge may be required. These dredges generally resuspend less material than conventional dredges, but associated costs may be much greater. As in the case of conventional dredges, the selection of a special purpose dredge will likely be dictated by site specific conditions, economics and availability.

Several field demonstrations have been conducted which serve to document equipment performance when dredging contaminated sediments. A full-scale demonstration of innovative dredging equipment for removal and handling of contaminated sediments was conducted at Calumet Harbor, Illinois.[17] The equipment selection process was documented and a field pilot evaluation of conventional and specialty dredges was performed at a Superfund project at New Bedford, Massachusetts.[18] That pilot study demonstrated that available dredging equipment and available dredged material management techniques were adequate for that Superfund material, and that contaminant release and mobility during dredging operations was insignificant when compared with background conditions.[19] Several pilot demonstrations of dredging equipment have also been recently conducted or are planned in connection with the EPA Assessment and

17. D.L. HAYES ET AL., U.S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION, MISC. PAPER EL-88-1, DEMONSTRATIONS OF INNOVATIVE AND CONVENTIONAL DREDGING EQUIPMENT AT CALUMET HARBOR, ILLINOIS (1988).

18. Michael R. Palermo, *Equipment Choices for Dredging Contaminated Sediments*, REMEDIATION ENVTL. J. Autumn 1991, at 473, 481-91.

19. *Id.* at 490-491.

Remediation of Contaminated Sediments (ARCS) program,[20] including a demonstration on the Buffalo River. Such field demonstrations serve to document the performance of both conventional and innovative dredge types in removing contaminated sediment with minimal resuspension and with required precision.

## III. DISPOSAL ALTERNATIVES FOR CONTAMINATED SEDIMENTS

### A. *Three Options*

Environmental dredging involves removal of contaminated sediment from a water body. What to do with this dredged material, *i.e.*, what disposal or management option is appropriate or acceptable, is a major consideration for any cleanup project. There are three alternatives normally available for disposal of dredged material: open-water disposal, confined disposal, and beneficial use. Each of these alternatives involves its own set of unique considerations. Selection of an alternative should be made based on environmental, technical and economic considerations.[21]

1. *Open-Water Disposal.* Open-water disposal is the placement of dredged material in rivers, lakes, estuaries or oceans via pipeline or release from hopper dredges or barges. Sediment found to be contaminated would be unsuitable for open-water disposal without appropriate management options aimed at reducing release of contaminants to the water column during disposal and/or subsequent isolation of the material from benthic organisms once disposal is completed. Such options include operational modifications, use of subaqueous discharge points, diffusers, subaqueous lateral confinement

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20. Pursuant to the Great Lakes Critical Program Act of 1990, 33 U.S.C. § 1268(c)(7)(B)(ii), the Great Lakes National Program Office initiated five pilot demonstrations in 1991. Four of the demonstrations examined methods of extracting organic contaminants: a low temperature thermal stripping process at the Ashtabula River, Ohio; a low temperature thermal stripping process at the Buffalo River, New York; a solvent extraction process at the Grand Calumet River, Indiana; and a physical separation technology test at the Saginaw River, Michigan. Sediment Remediation Technologies Selection Notice, 56 Fed. Reg. 20,222 (1991). In addition, the ARCS program provided technical support and assistance at the Sheboygan, Wisconsin Superfund site through EPA's Athens, Georgia Environmental Research Laboratory. *Id.*

21. NORMAN R. FRANCINGUES ET AL., U.S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION, MISC. PAPER D-85-1, MANAGEMENT STRATEGY FOR THE DISPOSAL OF DREDGED MATERIAL: CONTAMINANT TESTING AND CONTROLS (1985).

of material or capping of contaminated material with clean material.

2. *Confined Disposal.* Confined disposal is the placement of dredged material within nearshore dikes or upland confined disposal facilities (CDFs) via pipeline or other means. CDFs may be constructed at upland sites, nearshore sites with one or more sides in water or as island containment areas. These sites are a commonly considered alternative for storage of contaminated sediments. When using CDFs for disposal of contaminated material, the different pathways for potential contaminant release should be considered. These include effluent discharges to surface water during filling operations, rainfall surface runoff, leachate into groundwater, volatilization to the atmosphere and direct uptake by plants and animals. If required, control measures to minimize contaminant impacts such as operational modification, treatment, liners or covers are incorporated into the design and management plan for the CDF. CDFs may also be a necessary first step or pretreatment option for highly contaminated material prior to more intensive treatment processes.

3. *Beneficial Use.* Beneficial use includes a wide variety of options which utilize the material for some productive purpose. Some common examples include use of sand for beach nourishment, or use of fine material for wetland enhancement or restoration. However, contaminated material removed from cleanup operations would normally be unsuitable for most beneficial uses.

B. *Management Strategies*

A major consideration in evaluating the above options for disposal of contaminated sediments is to assess the environmental acceptability of the proposed alternatives. In 1985, the USACE developed a management strategy for open water and confined dredged material disposal alternatives which focused on contaminant testing and controls.[22] The USACE and EPA later jointly developed an expanded and refined strategy which serves as a framework for evaluating the environmental acceptability of dredged material disposal alternatives.[23] The study began with an initial evaluation of sediment contamination, followed by an evaluation of potential contaminant pathways. It ended

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22. *Id.*

23. MICHAEL PALERMO & NORMAN R. FRANCINGUES, U.S. ARMY WATERWAYS EXPERIMENT STATION, TECHNICAL NOTE EEDP-06-14, FRAMEWORK FOR EVALUATING ENVIRONMENTAL ACCEPTABILITY OF DREDGED MATERIAL MANAGEMENT ALTERNATIVES (1991).

with an evaluation of appropriate contaminant controls and management approaches. Additional guidance on strategies and alternatives for management of contaminated sediments has been summarized for the ARCS program. Such technical strategies or frameworks have direct application to cleanup projects and provide the tools to properly evaluate alternatives and determine the need for contaminant controls.

## IV. STATUTORY AUTHORITY FOR DREDGING

Until recently, there was no specific USACE mission or authority to dredge for cleanup or environmental purposes. However, other federal agencies have various authorities for sediment cleanup. Because of the varied nature of existing authorities, contaminated sediments have been handled on a piecemeal basis. Cleanup dredging done by the USACE was always conducted as "work for others" or as a reimbursable project funded by another agency or group. The earliest efforts were carried out under authority of the Federal Water Pollution Control Act[24] and were funded by EPA. Under this authority, actual cleanup dredging was limited to sediment contaminated by a PCB spill in 1976 in the Duwamish Waterway in Puget Sound.[25] During the early to mid-80s numerous EPA funded cleanup activities were associated with Superfund projects pursuant to the Comprehensive Environmental Response Compensation and Liability Act[26] and the Superfund Amendments and Reauthorization Act of 1986.[27] Nearly a dozen activities are at various stages of completion and range from identification and assessment of contamination to field demonstration of dredging and remedial technologies.

The Water Quality Act of 1987[28] has authorized a contaminated sediment program specifically for the Great Lakes to identify and assess the extent and magnitude of sediment contamination and to demonstrate bench scale treatment technologies for the contaminated sediments.[29] EPA now has the Great Lakes National Program Office (GLNPO) and

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24. 33 U.S.C. §§ 1251-1387 (1988).

25. J.N. BLAZEVICH ET AL., U.S. ENVIRONMENTAL PROTECTION AGENCY, MONITORING OF TRACE CONSTITUENTS DURING PCB RECOVERY DREDGING OPERATIONS, DUWAMISH WATERWAYS (USEPA Report 910/9-7-039) (1977).

26. 42 U.S.C. §§ 9601-9675 (1980).

27. Superfund Amendments and Reauthorization Act of 1986, Pub. L. No. 99-4999, 100 Stat. 1613.

28. Water Quality Act of 1987, Pub. L. No. 100-4, 101 Stat. 7 (1988).

29. *Id.*, 33 U.S.C. § 1268(c)(7)(A) (1988).

is conducting demonstrations and related investigations under the Assessment and Remediation of Contaminated Sediments (ARCS) program. Funding for this program is from EPA with the USACE leading in treatment technologies. Actual cleanup is not authorized in this program.

Under CERCLA,[30] NOAA, the Fish and Wildlife Service, and the states act as "natural resource Trustees" to access and claim damages for injuries to natural resources due to release of hazardous substances. Recent initiatives involving the USACE are being carried out for NOAA under this authority and involve the restoration of selected contaminated coastal areas. The Water Resources Development Act of 1990[31] contains the first specific USACE authority for sediment cleanup activities. The section of the Act entitled "Environmental Dredging"[32] provides for removal of contaminated sediments outside the boundaries of and adjacent to a Federal navigation project as part of the operation and maintenance of the project.[33] The Act further provides for removal of contaminated sediments for the purpose of environmental enhancement and water quality improvement if such removal is requested by a non-Federal sponsor and the sponsor agrees to pay 50% of the cost of removal and 100% of the cost of disposal.[34] The USACE has recently developed policy and procedures for undertaking environmental dredging under this authority.[35] With this authority, the first steps toward a more concentrated and less piecemeal approach to management and cleanup of contaminated sediment have been taken.

## V. CONCLUSION

USACE research efforts and field experience related to contaminated sediments have spanned a period of over 20 years. As a result, the Corps is recognized worldwide as an expert in the environmental aspects of dredging and dredged material disposal. USACE policy is evolving as environmental, technical, and non-technical issues associated with these projects become better understood. However, a nationally consistent identification, assessment, and

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30. *See supra* note 9.

31. *See supra* note 2.

32. *Id.* at 4639.

33. *Id.* at 4640.

34. *Id.*

35. U.S. ARMY CORPS OF ENGINEERS, POLICY GUIDANCE LETTER NO. 35, SECTION 312 OF THE WATER RESOURCES DEVELOPMENT ACT OF 1990, ENVIRONMENTAL DREDGING (memorandum CECW-PA/CECW-OD) (Mar. 25, 1983).

management framework for contaminated sediments is currently lacking and should be jointly initiated by the USACE and EPA. As the nation's environmental engineer and dredging expert, the USACE stands ready to contribute to this effort and to the success of cleanup efforts involving dredging.