CONTAMINATED SEDIMENT REMOVAL PROGRAM pdf

1: Contaminated Sediment in the Great Lakes | The Great Lakes | US EPA

The rate of sediment remediation activities, removal of beneficial use impairments and delisting of AOCs has accelerated since the Great Lakes Legacy Act and Great Lakes Restoration Initiative funding programs were implemented.

Open topic with navigation 6. Removal by Dredging and Excavation Dredging or excavation remedies remove contaminated sediment from freshwater or marine water bodies in order to reduce risks to human health and the environment. Removal is particularly effective for source controlThose efforts that are taken to eliminate or reduce, to the extent practicable, the release of COCs from direct and indirect ongoing sources to the aquatic system being evaluated. Incorporating design features for resuspension control and residuals management can further reduce risk. After removal, the contaminated sediment can be treated or disposed in a controlled setting, such as an off-site landfill or other treatment, storage, and disposal TSD facility, an on-site aquatic or terrestrial confined disposal facility CDF , or a facility that converts the sediment to a reusable product. Under favorable circumstances, sediment removal can be effective in achieving RAOs, as illustrated in the case studies in Appendix A , which are summarized in Section 6. Removal has the potential, however, to disrupt the sediment and aquatic environment in the short term. Removing contaminated sediment can liberate a significant quantity of contaminants and leave residuals that may pose significant risks. Removal implementation costs are often higher than costs of other technologies, thus the selection process for this approach must balance costs, the site characteristics that drive applicability and limitations, and the net risk reduction that this approach can achieve. With a thorough site characterization, some of the removal challenges can be addressed through design and by using best management practices BMPs during operation. By comparison, environmental dredging dredging for the sole purpose of removing contaminated sediment is a relatively new development. While navigational dredging experience can be applied to environmental dredging projects, these applications have several key differences. For example, navigational and environmental dredging differ in their respective production rates the amount of material dredged per hour. In navigational dredging, the production rate determines dredging effectivenessâ€"a higher production rate results in a more successful project. In environmental dredging, production rate can affect the cost of the project, but not necessarily the success of the project. For environmental dredging operations, the removal operation is highly controlled, with efforts focused on minimizing the removal of clean material while, at the same time, controlling contaminant residuals and limiting the spread of contaminants. This level of control is often achieved at the cost of production rate. For an environmental project, remedial objectives can still be met despite a low production rate. Additionally, the controlled dredging needed for environmental projects results in a more resource-intensive operation than navigational dredging. A third method, excavation, is also described because it has been used at a number of sites in recent years. Dredging and excavation inevitably affect the aquatic and benthic environments, and this chapter presents some ways to minimize these effects. As with any type of removal operation, additional technologies are required to appropriately handle the removed sediment. Dredged material handling technologies may involve transport, dewatering, treatment, and or disposal of sediment. The dredged material is removed at near in situ solids content and density. A mechanical dredge usually consists of the following: This concept is used chiefly for environmental studies evaluating the stratification or mixing such as by wind induced currents of the thermal or chemically stratified layers in a lake, stream or ocean. Some of the common parameters analyzed in the water column are: Understanding water columns is important, because many aquatic phenomena are explained by the incomplete vertical mixing of chemical, physical or biological parameters. For example, when studying the metabolism of benthic organisms, it is the specific bottom layer concentration of available chemicals in the water column that is meaningful, rather than the average value of those chemicals throughout the water column. More detailed descriptions of each mechanical dredge types can be found in Section 5. Depending on site conditions, mechanical dredging equipment can sometimes be operated from shore; however, most dredges are set up on a barge floating platform equipped with an anchoring system, such as spuds, to hold it in place. Dredged sediment from near-shore locations can sometimes be transferred to shore by the same mechanical dredge and barge. If the dredging site is further from shore, the dredged sediment may be transferred to a second barge that hauls the sediment to the handling and disposal facility. Access to shore-side facilities or infrastructure is often used to provide an off-loading area or staging area for treatment or dewatering of the dredged sediment. A hydraulic dredge usually consists of a dredge head and a hydraulic pump. The dredge head is lowered into the sediment bed to fluidize the sediment by mechanical agitation and to draw the slurry into the suction pipe. Cutter heads and horizontal augers are the most common forms of dredge head design for environmental dredging. The hydraulic pump may be deck mounted or submersible. Additional equipment needed for hydraulic dredging includes a ladder or cable used to support the dredge head and lower it into the water, as well as to swing the dredge head to advance into the sediment face. Most hydraulic dredges use spuds, which are devices driven into the sediment to stabilize the discharge line and the dredge, as they are operated or maneuvered using a cable system. A number of specialty hydraulic dredges are also available, including purely suction devices often used to dredge residuals or fluid sediments. These specialty dredges can also use water jets or pneumatic methods to fluidize the sediment, but these approaches are less common. Hydraulic dredges without mechanical agitators for fluidization are called "plain suction" dredges. A vacuum hose without an agitator can be used for dredging loose sediment at some sites. This operation is usually assisted by divers who guide the hose around obstacles. The volume of water added to create a slurry that can be pumped referred to as carrier water depends on the in situ solids content of the sediment, sediment grain size, and pumping distance. For environmental dredging projects, the volume of carrier water needed is typically 5â€”10 times the in situ volume of sediment, which equates to 1,â€”2, gallons per in situ cubic yard. When applicable, hydraulic dredging is economical for removing large volumes of sediment and is used in both navigational and environmental dredging. In an excavation remedy, operators isolate a segment of the sediment and water column in an enclosure, dewater the enclosure, and remove the exposed sediment using conventional land-based excavation equipment. To isolate an area for dewatering, containment structures such as cofferdams, earthen berms and sheet piles are first installed to seal off the area and encircle the contaminated sediments. Once isolated, the interior of the enclosure can be pumped to remove water prior to sediment removal. Excavation equipment is often similar to that used in mechanical dredging and includes excavators, backhoes, and clamshells. In areas with large tidal swings, significant seasonal tidal changes, or intermittent streams and wetlands, excavation can be performed during low-water conditions and sometimes without an enclosure. Excavated sediment usually contains less water than dredged sediment and thus is easier to handle. Excavated sediment, however, may still require additional land-based dewatering or solidificationTo make solid, compact, or hard, to make strong or united, or to become solid or united. In general, improved access to target dredging areas, greater control on dredge cuts, reduced concerns regarding resuspension of residuals, and potentially reduced sediment dewatering needs are the primary factors for selecting removal by excavation rather than by dredging. Some conventional navigational dredging equipment has been customized to meet specific needs at larger sites. Enhanced planning and operational procedures, however, have been shown to improve removal efficiency and reduce the resuspension of sediment and generation of residuals for sites of any size. Residuals and resuspension are significant technical, environmental, and economic considerations for dredging see Section 6. Reducing residuals and resuspension improves the overall effectiveness of removal and excavation technologies. In this method, a site is divided into cells or "bands" of varying contaminant concentrations. Cells are removed by dredging or excavation to meet a site-wide SWAC that is below the remediationThe act or process of abating, cleaning up, containing, or removing a substance usually hazardous or infectious from an environment. Often, the highest concentration cells are targeted for removal first because remediating these cells significantly reduces the SWAC. The SWAC approach has proven effective as a target in field applications. At several recent mechanical and hydraulic dredging sites, dredging targeted sediments that were causing an exceedance of a SWAC equal to the cleanup goal. Backfilling was used in some areas with persistent residuals. When low concentration goals are established for a site targeted for removal, residuals and resuspension or deposition may affect the attainment of these remedial goals. At a number of dredging sites, multiple dredging passes have been required to remove the residuals deposited and, in some cases, cappingTechnology which covers contaminated sediment with material to isolate the contaminants from the surrounding environment. At the GM Massena site St. Lawrence River, NY , following more than 15 dredge passes, backfilling of dredged areas with clean material was required to achieve 1 ppm of PCBs in portions of the dredge prism. Consequently, residuals management plans are now being developed along with the removal plan in order to optimize the number of dredging passes and reduce resuspension, contaminant release, and erosion of residuals. In planning for removal of contaminated sediments, site project managers must also consider biological factors. Fish reproduction or benthic community survival windows often permit removal only during certain times of the year referred to as "dredging windows". Additionally, benthic community structure may restrict the times during which removal can occur. While dredging does not usually damage fisheries, the effects of removal on the benthic community must be evaluated during planning. Additionally, the upland habitat of endangered species or sensitive wetlands habitat may be affected by sediment removal operations. Site evaluations must consider potential risks to these habitats when selecting access sites, lay-down areas, staging areas, and transfer areas. At many sites, dredge operators have addressed accuracy limitations by over dredging overlapping cuts. Over dredging materials, however, can become significant where the processing and disposal costs for removed sediments are high. The USACE guideline contains a more detailed discussion of vertical and horizontal dredging accuracy. Although sophisticated positioning systems have been used at a few large sites, such as Fox River and Green Bay , at many moderately-sized sites, project teams have tried to incorporate some version of advanced positioning into dredging operations. Over-dredging usually proves to be an easier method to reach target depths and remove sufficient sediment. Bathymetric measurements before and after dredging are typically used to verify that target depths have been reached. Several recent advances in dredging operations have improved targeted removal operations Pastor One advanced positioning system, real-time kinematic global positioning, allows dredging to be focused on specific areas and depths, thus minimizing the requirement for over-dredging to achieve design goals. At some sites, this advanced positioning system can be an alternative to over dredging and its associated increased costs and materials handling. Finally, operator training and experience are other important variables in sediment removal that affect removal success Pastor A state-of-the art technology, RTK GPS indicates to the operator exactly where the dredge head is located while it is underwater Pastor For each cut, the dredge is positioned in the water using RTK GPS and a series of electronic sensors measure tilt angle, acceleration, shock, vibration, and movement. The position of the cutter head is tracked and recorded in relation to the dredge. Special software uses input from the GPS and sensors to show the operator the exact position of the cutter head. The technology cost several hundred thousand dollars, but it is expected to save money and time through improved efficiency. This system targets the neat line, a location identified during sediment characterization as the depth where PCB levels in the sediment drop from over 1 ppm to under 1 ppm the target cleanup level. The operator reviewed the site map and make multiple dredging passes, often dredging more than was necessary. Although the RTK GPS was developed to work with hydraulic dredges, a similar system has been used in other places, such as Commencement Bay in Washington, with a clamshell dredge. According to USEPA staff, this system has not yet become standardized because of high development costs. In addition, the different sediment types such as mud versus sand and varying conditions and accessibility at different sites have also slowed the development of a standard system. A variation of the conventional clamshell bucket, the enclosed dredge bucket, has been developed to limit spills and leaks from the bucket. An enclosed bucket reduces resuspension by improving the seal between the elements of a closed bucket.

2: Flint River Sediment Remediation on Former MGP Site - Sevenson

EPA's Assessment and Remediation of Contaminated Sediment (ARCS) Program Guidance for In-Situ Subaqueous Capping of Contaminated Sediments (U.S. EPA d) and the Assessment and Remediation of Contaminated Sediments (ARCS) Program Remediation Guidance Document (U.S. EPA d).

The Port of Bellingham owns the upland properties and is managing environmental cleanups in and around the waterway. Phase 1 construction of the remediation was conducted between July and June American Construction Company was the prime contractor for dredging and land-based construction work. Anchor QEA completed engineering design work for the project starting in with final design and project tender occurring in early Construction started in summer and in-water work was completed in March ; some additional upland closeout work was completed through summer and baseline monitoring was performed in fall Closeout reporting and Year 1 monitoring efforts were completed in Historic contamination in Whatcom Waterway is from industrial activities, including mercury discharges from a former chlor-alkali plant, wood waste and degradation products from past log rafting activities, and phenolic compounds from pulp mill wastewater discharges. Mercury was the primary contaminant of concern to inform the engineering design for remediation of the waterway. The remediation was conducted by the port under a multi-phase Consent Decree that was negotiated with the Washington State Department of Ecology Ecology. The Consent Decree includes a multi-phase approach for remediation of the entire cleanup site, and the primary objective of the Whatcom Waterway Phase 1 Cleanup Project was to address the risks to human health and the environment in the cleanup area. General management goals for Phase I included reducing contaminant mass by dredging, capping contaminated sediment that could not be removed, maintaining the use of the waterway for local industry and recreational purposes, and improving shoreline conditions for public access and habitat creation. Activities included dredging and landfill disposal of , cubic yards of contaminated sediment, placing approximately , square feet of engineered sediment caps, removing approximately 1, feet of treated timber bulkheads, removing more than 5, square feet o Inner Waterway dredging operations using a five cubic-yard digging bucket, with the debris booms deployed. Dredging Contaminated Sediment The engineering dredge design included removing the highest concentrations of contaminated sediment followed by capping. The port is required per tenant operational agreements to maintain the navigable portions of Whatcom Waterway to elevation feet mean lower low water MLLW. Engineering studies identified contamination extending well below the limits that would allow for full removal of the contaminated materials, and the cleanup design was developed to achieve removal of the maximum amount of contamination practicable while meeting waterway operational use requirements. The dredging design for the Inner Waterway remediation area included removing , cubic yards of contaminated sediment to elevation feet MLLW in the navigable portions of the waterway and placing an engineered sediment cap over the underlying contaminated sediment to elevation feet MLLW. The elevations for dredging and engineered sediment cap construction allowed for future maintenance dredging activities to feet MLLW in the navigable portions of the waterway. American Construction used two dredges on the project â€” the ton DB Mukilteo for dredging contaminated material, and the ton DB Palouse to place the capping material. The Mukilteo was equipped with a 5. Dredged material was offloaded, re-handled into rail cars and then transported via rail to the Columbia Ridge Landfill operated by Waste Management in Arlington, Oregon. After dredging was complete, the DB Palouse, using a five cubic yard digging bucket, placed a cap consisting of 12 inches of sand covered by six inches of armor consisting of two-inch cobbles. Capping material was obtained from a local source and brought to the site by truck, then loaded via conveyor onto material barges. Capping along the shoreline was accomplished using upland equipment, and all work was verified by hydrographic surveys. The port is responsible for maintaining water depth in the waterway and will conduct maintenance dredging in the future Construction Sequencing Construction sequencing was a critical element for the project schedule as in-water work was required to be completed in one construction season August through March to meet project timeline and budget constraints. Dredging and capping were sequenced to mitigate slope stability and structural considerations in the confined space of the waterway. The engineering designed specified dredging areas and sequencing requirements for all dredging to prevent recontamination of remediated areas adjacent to ongoing dredging activities and to minimize disruption of port tenant operations. Onshore debris removal and soil excavation was managed on-site for re-use or off-site disposal at a local all-purpose landfill. Upland remediation included dealing with contamination. Petroleum-impacted soils were discovered when removing a barge ramp structure, generating impacted construction water that could not be discharged to the waterway. The upland property is still going through cleanup process with Washington Department of Ecology. The groundwater is not being treated though it may be in future when the upland cleanup work is completed. Dredging was completed after installing the containment wall, followed by placing the engineered sediment caps to stabilize the dredge slopes and containment wall structure. The port is seeking tenants for other properties on the waterway and has redevelopment plans at the former GP Mill site. Sustainable Approaches The project involved implementing several sustainability approaches during the cleanup activities. The remediation work generated significant quantities of shoreline debris including large pieces of concrete from the building foundations of shoreline and upland structures. These large pieces of debris were removed from the shoreline and upland areas and brought to an upland stockpile area on port property where they were crushed and stored for beneficial use as structural fill during upland development for the former chlor-alkali mill upland area, instead of being disposed at an off-site landfill facility. A large clarifier on the Inner Waterway shoreline included a pile-supported concrete foundation. The project required removal of the above-ground portion of the structure to allow removal of a shoreline bulkhead structure and regrading of the shoreline slope. The pile-supported foundation was left in place, and non-contaminated fill was placed in the foundation to help bring the upland area to grade after the clarifier was demolished. This sustainable approach reduced overall volume of demolition debris and allowed for beneficial re-use of excavated materials on-site as structural fill rather than removing the materials for off-site landfill disposal.

3: Superfund | US EPA

This project will provide funds to Escambia County for planning, design, and acquisition of all federal and state environmental compliance and permits for the dredging and removal of sediments enriched with nutrients and hydrocarbons from the northern area of Bayou Chico.

The information was compiled by Mr. Many individuals contributed to the preparation and review of this document; a partial listing appears below. Sediment Toxicity Methods Dr. Procedures for Characterization of Contaminated Sediments Dr. Joe Corrado, Malcolm Pirnie, Inc. Such sediments may be found in large sites, such as the harbors of industrialized ports. However, they are also frequently found in smaller sites, such as streams, lakes, bayous, and rivers. In response to the risk that contaminated sediments pose, new methods for the remediation of contaminated sediment problems have developed rapidly during the last few years. Remediation options include no action monitored natural attenuation , removal, treatment, and containment. All areas of contaminated sediment remediation have seen considerable development, especially technologies for the treatment of contaminated sediments. This handbook focuses on small site contaminated sediments remediation with particular emphasis on treatment technologies. The handbook is organized to address the major concerns facing contaminated sediment remediation. Chapter I describes the physical and chemical characteristics of sediment, with special emphasis on ways in which sediment property changes affect contaminant mobility. Chapter II addresses sediment toxicity assessment and describes the current status of the EPA effort to address this important topic. Chapter III discusses sampling techniques and analytical and modeling methods used to characterize contaminated sediments. Chapter IV describes removal and transport options. Chapter V presents pre-treatment technologies. Chapter VI, the primary focus of this handbook, describes four major classes of treatment technologies. This chapter offers a comprehensive overview of specific treatment technologies and addresses applicability, limitations, and demonstrated results; it also presents references for further information. Finally, Chapter VII reviews disposal alternatives for contaminated sediments that are not treated. Its primary components are interstitial water and soil particles. Interstitial water can comprise up to 90 percent of the total volume of unconsolidated, top sediment horizons and close to 50 percent of deeper, more compacted sediments. Soil particles found in sedi- ments are derived from surface erosion of soils in the watershed, bank erosion, and redistribution of the bed load in waterways. Sediments vary widely in particle size distribution and are generally finer in texture than their source soils. Segregation of particle size occurs within the water body as a result of currents such that the smaller particles accumulate in quiescent zones and coarser particles are found where the current is greater. Organic matter, another important component of sediment, may range from near zero to greater than 10 percent of the sediment solid phase. Sediments are a very important part of aquatic ecosys- tems and in and of themselves should not be considered a problem. They can become problematic in at least three ways: This third type of problem is the focus of this document. Contaminated sediments threaten human health when humans drink water contaminated by contact with sediments, eat organisms such as fish and shellfish contaminated through bioaccumulation in the food chain, or come in direct dermal contact with contami- nated sediments. These impacts can be transferred throughout the ecosys- tem via food chain links and other ecological mecha- nisms. Contaminants enter the water body from point sources such as municipal and industrial effluents , non-point sources such as agricultural and urban runoff , and other sources such as spills, leaks, and dumping of wastes. A portion of the contaminants may then settle in the sedi- ments. Common contaminants of concern include halo- genated hydrocarbons PCBs, dioxins, many pesticides, etc. Although many of the organic contaminants do degrade with time, the rates of degradation are generally slow and these chemicals tend to remain in the sediments for long periods of time, thus increasing their impact on the environment. Metals, as elements, do not degrade. The physical and chemical characteristics of sediments exert a great deal of influence upon, the bioavailability of sediment contaminants. These characteristics vary greatly from site to site. As a result, site characteristics should impact remediation decisions. This chapter reviews sediment characteristics to evaluate when selecting from among remediation alternatives. These alternatives in- clude no action, treatment, containment, and disposal. Important physical and chemical changes may occur in contaminated sediments during their removal, handling, transport, treatment, and disposal. Important factors to consider during this selection process include the following: Nature and magnitude of the contamination. Chemical and physical properties of the sediment. Remediation alternatives potentially available. Behavior of the contaminant s under different reme- diation alternatives. Supplemental management practices that may be applied at a disposal site to further enhance contami- nant immobilization. These factors must be considered because the physical and chemical properties of a dredged material, and a change in those properties, can have a substantial effect on releaseof contaminants. Understanding these changes and the interaction between sediments and contaminants enables selection and management of remediation alter- natives to minimize contaminant release. Generally, sandy sediments have little attraction for either toxic metals or synthetic organics pesticides and industrial organics. Fine tex- tured sediments such as silt and clay have a much greater affinity for all classes of contaminants. Fine-textured material at the sediment-water interface and suspended silt and clay particles effectively scavenge contaminants from the water column. These particles tend to accumu- late in more quiescent reaches of waterways. Separation of the less contaminated sandy fraction from contami- nated sediments can often yield a material clean enough for disposal without restriction while also reducing the volume of the contaminated sediment requiring treat- ment. Another very important physical property is the organic matter content. Fine textured sediments, more so than sandy sediments, generally contain from one to several percent naturally occurring humic material derived from the microbial transformation of plant and animal detritus. Humic material may be present as discrete particulates or as coatings on clay particles and is important in two respects: Measurement of in situ water content is a third physical property of sediments usually important to remediation decisions. Weakly acidic, neutral, and slightly alkaline conditions higher pH favor metal immobilization processes. The oxidation-reduction status of a sediment, measured as redox potential, has a major effect on the retention or release of a number of metals, either directly or as a result of the difference in reactions of metals with oxidized and reduced sediment constituents. Changes in pH and redox potential of contaminated sediments from their initial condition at a dredging site to different conditions at a remediation site can substantially affect contaminant immobilization proc- esses. Other important chemical properties of sediments include salinity conditions, sulfide content, the amount and type of cations and anions, and the amount of potentially reactive iron and manganese. These ele- ments are usually present in soils and sediments at low concentrations from natural sources. It is when one or more of these contaminants is present in elevated con- centrations that they pose a potential problem. Real problems exist if these excess metals are released to the water column or are present in forms readily available to plants and animals that come in contact with the sediment material. Metals dissolved in the water column or pore water are considered most available to organisms. Metals bound to clay minerals and humic material by cation exchange processes are also considered relatively available due to some equilibrium between these bound metals and dis- solved metals. On the opposite extreme are metals bound within the crystal lattice structure of clay minerals. Metals in this form are essentially permanently immobi- lized and unavailable. Between these extremes are potentially available metals. The bulk of metals in con- taminated sediments are in these potentially available forms. A listing of some of the common chemical forms of metals ranging from most available to least available is presented in Table The chemical properties of sediments also greatly affect the mobility and biological availability of contaminants. Therefore, understanding the influence of the sediment chemical environment, and controlling changes in this environment, are important to the selection of disposal alternativesforcontaminated sediments. Table shows the fate of the potentially available metals as sediment conditions change. It should be mentioned that there may be a complemen- tary interaction between some of these processes as the pH or oxidation status of a sediment is altered. As metals are released from one form, they may be immobilized again by another process. However, the potential effi- ciency of this complementary interaction of processes depends on the particular properties of the sediment material. Organic contaminants can vary widely in water solubility depending on their molecular composition and functional groups. Like metals in a sediment-water system, most organic contaminants tend to become strongly associ- ated with the sediment solid phase, particularly the humie fraction. Thus, at most sites, the distribution of organic contaminants between dissolved and solid phases is a function of their water solubility and the percent of naturally occurring humic materials in the sediment. However, at heavily contaminated sites, organic contaminants also associate with petroleum-based or sewage- based organics. Unlike metals, however, organic contaminants do de- grade. Though all organic contaminants degrade at some rate, some have half-lives on the order of several dec- ades. Some organics are subject to enhanced degrada- tion rates under certain sediment chemical conditions. Typical Fate of Potentially Available Metals in a Changing Chemical Environment Metal Type carbonates, oxides, and hydroxides adsorbed on iron oxides chelated to humic sulfides Initial Condition salts in the sediment adsorbed in sediment chelated in sediment very insoluble precipitate Environmental Change reductions of pH sediment becomes reducing or acidic Result release of the metals as the salts dissolve iron oxides become unstable and release metals strongly immobilizes metal in both reducing and oxidizing sediments However, there is some indication that the process is less effective if a reduced sediment becomes oxidized sediment becomes oxidized sulfides become unstable, oxidize to sulfates, and release the metals 1. A Biogeochemical Evaluation of Disposal Op- tions. American Society of Civil Engineers, Treatability of Dredged Material Laboratory Study. Technical Report D, U. Contract Report D, U. Environmental Science and Technology, Journal of Environmental Qual- ity, Presently, several different kinds of tools are available to use in making decisions concerning sediment assessment and desired levels of remediation. Primary tools include environmental regulations and sediment assessment methods; descriptions of their current status form the major sections of this chapter. Types of ARARs include: Chemical-specific ARARs - Health or risk-based concentration limits or ranges in various environ- mental media for specif ic hazardous substances, pollutants, or contaminants. Chemical-specific ARARs may define protective cleanup levels.

CONTAMINATED SEDIMENT REMOVAL PROGRAM pdf

4: Removal by Dredging and Excavation

Information from ARCS Program activities will help address contaminated sediment concerns in the development of Remedial Action Plans (RAPs) for all 43 Great Lakes Areas of Concern (AOCs, as identified by the United States and Canadian governments), as well as similar concerns in the development of Lakewide Management Plans (LaMPs).

Delisting and Recovery Contaminated sediments are a significant problem in the Great Lakes basin. As a result, advisories against fish consumption are in place in most locations around the Great Lakes. Typically, projects use a two-phased sediment assessment approach: The first phase includes a comprehensive sampling of the entire AOC to help pinpoint the location of "hot spots. The overall goal is to generate the information needed to make scientifically defensible remediation decisions. EPA typically works closely with state agencies and local communities involved in the Remedial Action Plan process to develop sampling plans, testing protocols, and Quality Assurance Project Plans for individual projects. Top of Page Causes These contaminated sediments have been created by decades of industrial and municipal discharges, combined sewer overflows, and urban and agricultural non-point source non-point sourceDiffuse pollution sources i. The pollutants are generally carried off the land by storm water. Common nonpoint sources are agriculture, forestry, urban, mining, construction, dams, channels, land disposal, saltwater intrusion, and city streets. Buried contaminants posing serious human and ecological health concerns can be dredged up by storms, ship propellers, and bottom-dwelling organisms. As larger animals eat these smaller animals, the toxins move up the food chain, with their concentrations getting higher, often thousands of times higher. Fish at the top of the food chain, such as lake trout and salmon, can be unsafe to eat in some areas because of the heavy concentrations of toxic substances in their tissues. Fish-eating birds, including the bald eagle, may suffer low reproductive rates or produce offspring with birth defects. Top of Page Sediment Remediation While the problem of contaminated sediments persists in the Great Lakes, efforts are being made in the pursuit of remediating these contaminated sediments. In the years through , 5. The following graphs show the progress of sediment remediation, with yearly totals from through EPA has been responding to the need for gathering high-quality sediment information to assist AOCs in making remedial action decisions. EPA provides technical, financial, and field support for federal, state, and tribal partners to assist in addressing contaminated sediments and work aimed towards reaching remedial decisions and environmental restoration. They are locations where any of 14 beneficial uses are impaired. All RAPs have identified contaminated bottom sediments as a significant problem that must be addressed to attain beneficial uses. Before developing specific plans that detail how to remediate these contaminated sediment problems, it is critical to characterize the nature and extent of sediment contamination. Most AOCs, however, had access to only limited sediment information to assist them in addressing characterization and remediation questions. While the problem of contaminated sediments persists in the Great Lakes, efforts are being made to remediate these contaminated sediments. The rate of sediment remediation activities, removal of beneficial use impairments and delisting of AOCs has accelerated since the Great Lakes Legacy Act and Great Lakes Restoration Initiative funding programs were implemented. Contact Us to ask a question, provide feedback, or report a problem.

CONTAMINATED SEDIMENT REMOVAL PROGRAM pdf

5: Remediation of Contaminated Sediments {Handbook}

The Contaminated Sediment Removal Program (CSRP) was formed in following a request from the Great Lakes Cleanup Fund to the Environmental Protection Branch, Ontario Region (Environment Canada).

Page 1 Share Cite Suggested Citation: Contaminated Sediments in Ports and Waterways: Cleanup Strategies and Technologies. The National Academies Press. Marine sediments are contaminated by chemicals that tend to sorb to fine-grained particles: Approximately 14 to 28 million cubic yards of contaminated sediments must be managed annually, an estimated 5 to 10 percent of all sediments dredged in the United States. The many challenges to be overcome in managing contaminated sediments include an inadequate understanding of the natural processes governing sediment dispersion and the bioavailability of contaminants; a complex and sometimes inconsistent legal and regulatory framework; a highly charged political atmosphere surrounding environmental issues; and high costs and technical difficulties involved in sediment characterization, removal, containment, and treatment. The need to meet these challenges is urgent. The presence of contaminated sediments poses a barrier to essential waterway maintenance and construction in many ports, which support approximately 95 percent of U. The management 1 For purposes of this report, contaminated marine sediment is defined as containing chemical concentrations that pose a known or suspected threat to the environment or human health Page 2 Share Cite Suggested Citation: The committee determined that a systematic, risk-based approach incorporating improvements to current practice is essential for the cost-effective management of contaminated marine sediments. The committee identified opportunities for improvement in the areas of decision making, project implementation, and interim and long-term controls and technologies, as outlined in this summary. Although the study focused on evaluating management practices and technologies, the committee also found it essential to address a number of tangentially related topics e. As part of the three-year study, the committee compiled six case histories of recent or ongoing contaminated sediments projects, visited one of those sites, analyzed the relevant regulatory framework in depth, held separate workshops on interim controls and long-term technologies, and examined in detail how various decision-making approaches can be applied in the contaminated sediments context. The committee also examined the application of decision analysis in contaminated sediments management. Systems engineering and analysis are widely used in other fields but have not been applied rigorously to the management of contaminated sediments. The overall goal is to manage the 2 For purposes of this report, sediment management is a broad term encompassing remediation technologies as well as nontechnical strategies Remediation refers generally to technologies and controls designed to limit or reduce sediment contamination or its effects Controls are practices, such as health advisories, that limit the exposure of contaminants to specific receptors Technologies include containment, removal, and treatment approaches. Treatment refers to advanced technologies that remove a large percentage of the contamination from sediment. Page 3 Share Cite Suggested Citation: Although unlimited time and money would make remediation of any site feasible, resource limitations demand that trade-offs be made and that solutions be optimized. A number of decision-making tools can be used in making these trade-offs. Available tools include risk analysis, cost-benefit analysis, and decision analysis. Cost-effective contaminated sediments management requires the application of risk analysisâ€”the combination of risk assessment, risk management, and risk communication. Contaminated sediments are considered a problem only if they pose a risk that exceeds a toxicological benchmark. In its most elemental form, risk assessment is intended to determine whether the chemical concentrations likely to be encountered by organisms are higher or lower than the level identified as causing an unacceptable effect. The "acceptable risk" needs to be identified, quantified, and communicated to decision makers, and the risk needs to be managed. First, management strategies need to be identified that can reduce risk to an acceptable level. Second, remediation technologies need to be identified that can reduce the risk associated with contaminants to acceptable levels within the constraints of applicable laws and regulations. Third, promising technologies need to be evaluated within the context of the trade-offs among risks, costs, and benefits, a difficult task given the uncertainties in risk and cost estimates. The next step is risk communication, when the trade-offs are communicated to the public. At present, risk analysis is not applied comprehensively in contaminated sediments management. Risks are usually assessed only at the beginning of the decision-making process to determine the severity of the in-place contamination; the risks associated with removing and relocating the sediments or the risks remaining after the implementation of solutions are not evaluated. The expanded application of risk analysis would not only inform decision makers in specific situations but would also provide data that could be used in the selection and evaluation of sediment management techniques and remediation technologies. Cost-benefit analysis can also be useful for evaluating proposed sediment management strategies. Although risk assessments may provide information about the exposure, toxicity, and other aspects of the contamination, they may result in a less-than-optimum allocation of resources unless additional information is considered. For example, a given concentration of contaminants at a particular site might be toxic enough to induce mortality in a test species, but this information alone does not indicate the spending level that would be justified for cleanup. Cost-benefit analysis combines risk and cost information to determine the most efficient allocation of resources. The difficulty lies in the measurement of the benefits and costs, or, more to the point, the projection of what they will be, before a strategy is implemented. Cost-benefit analysis is not applied widely in contaminated sediments management. It is generally carried out only for major new navigational dredging projects, and the analyses are usually narrow in scope. Cost-benefit analysis could be used in many cases to help identify the optimum solution in which the benefits outweigh the costs i. The costs and benefits involved in contaminated sediments management are difficult to calculate and cannot be measured precisely, but cost-benefit analysis may be worth the effort; comprehensive cost-benefit analysis may be warranted in very expensive or extensive projects. Informal estimates or cost-effectiveness 3 analyses may suffice in smaller projects. As the demand for the remediation of contaminated sediments grows, and as costs and controversies multiply, decision makers need to be able to use information about risks, costs, and benefits that may be controversial and difficult to evaluate, compare, or reconcile. One approach that could help meet this need is decision analysis, a computational technique that makes use of both factual and subjective information in the evaluation of the relative merits of alternative courses of action. Decision analysis involves gathering certain types of information about a problem and selecting a set of alternative solutions to be evaluated The evaluation is used to determine and assess possible outcomes for each alternative. The outcomes are rated, and the results are used to develop a strategy that offers the best odds for successful risk management. Formal decision analysis is not yet widely used in the management of contaminated sediments. The committee examined this technique using a test case and determined that applications of decision analysis may be particularly timely now, because recent advances in computer hardware and software make it possible to perform such analyses in ways that are user friendly and interactive. Decision analysis could be especially valuable because it can accommodate more variables including uncertainty than techniques such as cost-benefit analysis that measure single outcomes. Decision analysis can also serve as a consensus-building tool by enabling stakeholders to explore various elements of the problem and, perhaps, find common ground. However, because decision analysis is technical in design and involves complex computations, it is probably worth the effort only in highly contentious situations in which stakeholders are willing to devote enough time to become confident of the usefulness of the approach. As a result, the current laws and regulations affecting contaminated sediments can impede efforts to implement the best management practices and achieve efficient, risk-based, and cost-effective solutions. This is a shortcoming of the governing statutes, not a criticism of regulatory agencies charged with implementing them. The timeliness of decision making is also an issue, given that it typically takes years to implement solutions to contaminated sediments problems. At least six comprehensive acts of Congress, with implementation responsibilities spread over seven federal agencies, govern sediment remediation or dredging operations in settings that range from the open ocean to the freshwater reaches of estuaries and wetlands. In addition, states also exercise important authority related to water quality certification and coastal zone management. In some cases, local laws may also apply. To complicate matters further, federal, state, and local authorities often overlap. The committee identified several areas of the current regulatory framework in which changes might be beneficial. The MPRSA requires biological testing of dredged material to determine its inherent toxicity but does not fully consider site-specific factors that may influence the exposure of organisms in the receiving environment, meaning that, at best, risk is considered only indirectly and the actual impact is approximated. Although the CWA procedures, which consider chemical and physical as well as biological characteristics in assessing whether the discharge of dredged material will cause unacceptable adverse impacts, are not risk-based, at least they do not specify rigid pass-fail criteria. They are geared to identification of the least environmentally damaging, implementable alternative. The Superfund remedial action program addresses risks and costs to some degreeâ€”an exposure assessment but not a full risk analysis is required to assess in-place risks; remedial alternatives are identified based on their capability of reducing exposure risks to an acceptable level; and the final selection involves choosing the most cost-effective solution. However, there are no risk-based cleanup standards for underwater sediments. Insufficient attention to risks, costs, and benefits impedes efforts to reach technically sound decisions and manage sediments cost-effectively. Similar inattention to risk is evident in the permitting processes for sediment disposal. It is currently necessary to secure different types of permits for the placement of sediments in navigation channels or ocean waters as part of the construction of land or containment facilities under the Rivers and Harbors Act , the dumping of sediments in the ocean under the MPRSA , the discharge of sediments in inland waters or wetlands CWA , and the containment of contaminated sediments on land RCRA. In addition, different regulations come into play depending on whether sediments are removed during navigational dredging CWA or MPRSA or are excavated for environmental remediation Superfund. The committee can see little technical justification for the differential regulation of contaminated sediments, given that neither the location of the aquatic disposal site freshwater versus saltwater nor the reason for dredging navigational dredging versus environmental remediation necessarily affects the risk posed by the contamination. The regulatory regime does not adequately address risk; instead it focuses rigidly on the nature of the activities to be carried out. This problem has been eased in some instances by the interpretation of regulations based on the intent of the underlying statute s. Systematic, integrated decision making can also be undermined by dredging regulations governing cost allocation and cost-benefit analysis. The federal government pays for most new-work dredging and all maintenance dredging but not for sediment disposal, except in open water. The local sponsors of federal navigation projects bear the burden of identifying, constructing, operating, and maintaining dredged material disposal sites, under the "project cooperation agreement" Page 7 Share Cite Suggested Citation: Because project sponsors must pay for disposal on land, whereas open-water disposal is paid for by the federal government as a component of dredging costs, the WRDA provision creates a strong preference for open-water disposal. Furthermore, a local sponsor bearing the full burden of disposal costs has little incentive to seek out opportunities for the beneficial uses of dredged material discussed in the next section. The cost of making use of dredge material adds to the project cost and may benefit only third parties. This inconsistent approach to cost sharing can lead to the economically irrational allocation of scarce societal resources. Additional inconsistencies are introduced in the area of cost-benefit analysis. As noted earlier, costs and benefits must be weighed for new dredging projects but not for the maintenance dredging of existing channels or for the disposal of dredged material. Most contaminated sediments sites are located in highly populated areas near the Great Lakes or the oceans. The nature of these sites virtually ensures that complicated ecological situations and difficult technical problems will have to be accommodated along with complex political circumstances involving multiple resource users and interest groups. Stakeholders include port managers and transportation officials who have strong economic reasons for dredging; federal, state, and local regulators responsible for protecting natural resources and enforcing regulations; and environmental groups, local residents, fishermen, and other marine resource users who are concerned about public health and natural resources. The successful management of contaminated sediments must respond to all dimensions of the problem: The committee determined that remediation and disposal projects need strong proponents and that the identification and timely implementation of effective solutions depend heavily on how project proponents interact with stakeholders, who often have different perspectives on the problem and proposed solutions. Because any participant in the decision-making process can block or delay remedial action, project proponents need to identify all stakeholders and build a consensus among them. The development of a consensus can be fostered by the use of various tools, including mediation, negotiated rule making, collaborative problem solving, and effective communication of risks. Stakeholder acceptance of contaminated sediments management projects can be fostered by the reuse of dredged material. Dredged material has been used for many purposes, including the creation of thousands of islands for seabird nesting, Page 8 Share Cite Suggested Citation: The policy focus and most of the experience to date have concerned the use of clean materials, but some contaminated sediments can also be used safely for certain beneficial purposes. Reuse can provide alternatives to increasingly scarce disposal sites while also making management plans more attractive, or at least palatable, to stakeholders. Some contaminated sediment sites have been successfully transformed into wetlands, and productive USACE research is under way on the safe use of contaminated sediments for "manufacturing" topsoil and landfill covers. However, funding for this type of research is limited, and technical guidelines have yet to be developed. Other barriers include the USACE policy of selecting lowest-cost disposal options with little regard to the possibilities of beneficial use and the uncertainties about whether the incremental costs of beneficial use should be borne by the project proponent or the beneficiary. Source Control Because accumulations of sediments interfere with deep-draft navigation, ports have no alternative but to dredge periodically in order to remain economically viable. If the sediments to be dredged are contaminated, then ports become responsible for both sediment disposal and any necessary remediation, even though they have no control over the source of the contamination. Upstream generators of contaminants often cannot be identified or held accountable, leaving ports to manage a problem that is not of their making. This responsibility could be shared by states when states do not already operate or oversee port agencies.

6: Site Restoration / Sediment Remediation - Environmental Quality Management, Inc.

In response to the risk that contaminated sediments pose, new methods for the remediation of contaminated sediment problems have developed rapidly during the last few years. Remediation options include no action (monitored natural attenuation), removal, treatment, and containment.

Dredging companies exhibiting included J. Sevenson Environmental Services and Carylon. Science and engineering companies involved in environmental dredging projects were well-represented among the attendees and presenters. Army Corps of Engineers personnel also presented papers and chaired sessions and panels. The technical program consisted of four instructor-led short courses platform presentations in five technical tracks four breakout panels and poster presentations in two evening sessions. Meals were served in the exhibit hall where the more than attendees visited 60 exhibit booths and viewed the poster presentations. Every aspect of dealing with contaminated sediments was examined during the conference from microscopic analysis of benthic organisms identification of toxic chemicals in sediments processes for dealing with contaminated sediments and high volume sediment removal and treatment. The hundreds of presentations and posters encompassed myriad topics of interest to the dredging industry. There follows descriptions of a sampling of these: In the Brazil Ministry of Environment identified this canal as the worst-contaminated estuary in Brazil. The elimination of the tidal flow created a stagnant canal where waste and debris collected. The natural fauna and flora died out resulting in a prevalent foul odor and unsightly mess. Stephens described a project beginning in to clear out the debris dredge the sediment into Geotubes and cap the tubes. An estimated two million cubic meters of sediments were involved of which cubic meters were contaminated. The foot-long tubes were stacked three layers deep and the material in the tubes eventually dewatered to 65 percent solids. The area was then capped and planted and today it forms an attractive entrance into the city with parks and hiking trails. Stephens will present a paper on another dramatic Geotube application at the Western Dredging Association annual meeting in Hawaii on August 25 through This project created a new container terminal â€” Embraport in Brazil â€” on a highly contaminated site by using the filled tubes to create a solid footprint for the port facilities. Morrish described a cubic yard cleanup of the Sheboygan River in Wisconsin that the company had just completed. Environmental Protection Agency which provides up to 65 percent of the funding for communities to clean up contaminated areas. This is one of several projects in the Sheboygan area. Ryba performed the dredging while Terra did upland stabilization on the project. Ryba used an excavator equipped with a prototype Cable Arm excavator clamshell and a crane equipped with a Cable Arm environmental clamshell bucket for the dredging which began in August See photo on page 5. The joint venture will complete the final restoration this spring. Smith decried the focus on deepening East Coast ports to the detriment of shipping in the Great Lakes. When they closed the North Central Division office in Chicago and gave authority to Cincinnati on the Ohio River â€” that began the decline of funding for the Great Lakes. Tyler Lee project manager at J. Brennan Matt Binsfeld manning the J. Brennan booth told IDR that the company is at capacity. Among the projects are at hydro-electric dams â€” specifically to install a penstock in Duluth. Among the projects are the continuing Fox River cleanup and environmental management on islands in Pool 9 of the Mississippi River for the Corps and contaminated sediment cleanup in the West Branch of the Grand Calumet River. During the technical sessions literally every paper describing mechanical removal of contaminated sediments depicted a Cable Arm Environmental bucket in use. The prospects are looking good for Del Tank he said. Sevenson is dredging 2. They will cap the area using 3. The system can clear an area of PCBs in a matter of months. The cones are mounted on three-by three-foot or four-by-four-foot sections and can be placed over an entire contaminated area. The Lewis Berger Group contributed five talks and a poster presentation during the conference. Poster Sessions The poster sessions presented a wealth of information with authors available to describe their projects. The posters were arranged at both ends of the exhibit hall and comprised presentations from every topic covered by the conference. The oil recovery work focused on overbank areas but was expanded when submerged oil was identified in some river areas that extended for up to 40 miles from the release. Tetra Tech was charged with characterizing the suspended sediment particle size distribution and associated total petroleum hydrocarbon TPH and polycyclic aromatic hydrocarbon PAH concentrations from selected locations. They did this using samplers consisting of polyvinylchloride pipes that captured fine-grained sediment using ambient flow to induce settling in the sampler body. The sampling continued through Andy Bullard and Eric Stern of Battelle co-chaired the conference. Both addressed the kickoff plenary session and introduced the keynote speaker Linda Greenlaw the swordfish boat captain whose experiences inspired the book and movie The Perfect Storm. At the concluding roundtable eight specialists in sediment conducted a discussion with the audience on the vision and future of the industry. Battelle is a research and development organization that holds a number of high-profile conferences every year. The next Contaminated Sediment and Remediation Conference is scheduled for Matt Binsfeld left and Glen Green in the Brennan booth. Durocher is headquartered in Cheboygan Michigan. Hull participated as a session chair speaker and panelist.

7: Remediation of Contaminated Sediments Training Course

The removal of contaminated sediment for the sole purpose of cleanup as part of navigation projects has been permitted only in recent years in the United States.

Human activities can affect marine sediments by accelerating the rate of accumulation and introducing contamination. Many chemical contaminants have an affinity for fine-grained sediment particles. Contaminated sediments are widespread in U. Industries located in or upstream of urban ports or industries that discharge wastes into waterways can be direct sources of contamination. Dense populations also contribute contaminants through sewage discharges, automobile emissions, and other waste-generating activities. Sediments can be contaminated by remote sources, such as stormwater runoff and suburban or agricultural effluents containing heavy metals, oil, pesticides, and fertilizers. Because estuaries have a natural tendency to trap sediment, contaminants from distant sources can be concentrated in already-stressed industrial harbors. Contaminants deposited from the atmosphere can be carried from sources even further afield. Recent studies have shown that about half of the metal contamination in the sediments of Long Island Sound may have come from atmospheric fallout Cochran et al. Contamination sometimes concentrates in "hot spots" but is often diffuse, with low to moderate levels of chemicals less than a meter deep but covering wide areas. Chemical contaminants associated with sediments can be considered toxic when they adversely affect living organisms. Submerged contaminated sediments may be in intimate contact with aquatic biota that may be affected adversely by, or serve as carriers of, contamination. Contaminated Sediments in Ports and Waterways: Cleanup Strategies and Technologies. The National Academies Press. Management of contaminated sediments is a complicated problem. At the legal level, ports that may have no causal role in the contamination of sediments but must still dredge channels are faced with a number of hurdles, including identifying and paying for space for the placement of dredged material and many chemical, regulatory, political, and technological challenges. Environmental risks may lead to the identification of human health risks and to limits on fishing or recreational uses of marine resources. The presence of contamination can make removing sediments that obstruct navigation in and around important ports very expensive. The choice of a remediation strategy is determined in large part by whether the driving force is environmental cleanup or navigational needs. In addition to influencing the choice of remediation strategies, the driving force also affects which laws and regulations apply. At least seven federal agencies and six comprehensive Acts of the U. Congress influence remediation or dredging operations for managing contaminated sediments in settings that range from the open ocean to the inland and freshwater reaches of estuaries and wetlands see Figure If environmental cleanup is the driving force, applicable laws include the Comprehensive Environmental Response, Cleanup, and 1 For purposes of this report, sediment management is a broad term encompassing remediation technologies as well as nontechnical strategies. Remediation refers generally to technologies and controls designed to limit or reduce sediment contamination or its effects. Controls are practices, such as health advisories, that limit the exposure of contaminants to specific receptors. Technologies include containment, removal, and treatment approaches. Treatment refers to advanced technologies that remove a large percentage of contamination from sediments. Sediments are "dumped" in the open ocean where the Marine Protection. Page 17 Share Cite Suggested Citation: Page 18 Share Cite Suggested Citation: Three federal agencies are most active in contaminated sediment issues. Other federal, state, and local agencies have a hand in these matters as well. States are authorized to establish water quality standards within their jurisdictions and can block actions, such as sediment dredging or disposal, if they violate these standards. States also have the authority to review plans for consistency with coastal zone management plans. Appendix B provides additional details on the regulatory framework. The overlapping jurisdictions of federal, state, and local authorities further complicate the situation, which is discussed further in the forthcoming section, Regulatory and Legal Challenges. The federal laws and regulations that apply to the handling and disposal of contaminated sediments are reviewed in detail in Appendix B. Management of Natural Resources Environmental cleanup, almost by definition, involves small volumes of highly contaminated sediment usually emanating from a known historical source and confined to well-defined areas. In environmental cleanup projects, the remediation strategy can be either in situ i. The removal of contaminated sediment for the sole purpose of cleanup as part of navigation projects has been permitted only in recent years in the United States. However, this apparently broad authority to clean up contaminated sediment in conjunction with federal navigation projects has not been used to date by the USACE for specific cleanup projects because of the inability to locate financially viable project sponsors and because of concerns about liability. When sediment removal is not required for navigation, contaminated sediment may go unrecognized and the problem remain undefined until some event e. Actual risk can be identified through a formal assessment a process described in Chapter 2. Sometimes the response to this risk has an obvious and direct impact and economic consequences, such as restrictions on particular fisheries. In other cases, the response may be less visible but still significant in terms of impact, as when a site is designated in a Superfund "hazard ranking. The full extent of the need for environmental cleanup has not been quantified, but it is substantial. Approximately marine sites 3 have been listed or proposed for inclusion on the National Priorities List NPL for long-term remedial action under Superfund, which addresses inactive or abandoned facilities that threaten public health or the environment. L is under way. The EPA has designed the database and compiled the data and is expected to submit the first report to Congress in Navigation Needs Contaminated sediments usually accumulate slowly over large areas of the seafloor, but they can also accumulate very rapidly, especially in artificially deepened and confined areas, such as navigational channels and anchorages. Sediments in these areas must be dredged to maintain navigable waters. Navigation dredging typically involves the removal of large volumes of material over a large area that contains many different types of contaminants, albeit in low concentrations, from multiple, unidentifiable sources. In situ remediation strategies, such as leaving the contaminated sediment in place i. When navigation is the driving force, usually only ex situ techniques can be considered because the sediment must be relocated so the channel or harbor can be deepened or widened. In isolated instances, however, overdredging and capping the contaminated fraction of the dredged sediment within the navigation channel can be considered. Estimates do not include disposal costs and are current, not constant, dollars. Dredging is commonplace in the United States and is essential to many of the routine activities and services Americans have come to expect and demand Maritime Administration, Dredging and associated sediment disposal are expensive. The actual costs vary dramatically depending primarily on the nature including contamination status of the material to be dredged, the distance it must be transported for disposal, the number and nature of the required handling steps, the extent to which pre-disposal treatment is necessary, and the need for post-disposal monitoring. For major projects, environmental regulators require that all alternatives be explored before a decision to dredge is made, to ensure that a less costly or more environmentally acceptable alternative has not been overlooked. Although the economic impact of not dredging sediment is difficult to quantify, there is no doubt that well maintained channels, ports, and harbors are essential if the United States is to continue to attract and retain commercial shipping Interagency Working Group on the Dredging Process, Approximately 95 percent of all U. Department of Transportation, There are two types of navigation dredging: Maintenance dredging is carried out to maintain existing navigation services, whereas new-work dredging is intended to expand existing navigation channels or make them accessible to ships of deeper draft or to create new ones. Maintenance dredging is the more common of the two types. From to , maintenance dredging in the United States moved, on average, approximately MCY per year. This total includes dredging by the USACE on the inland waterway system and in federal channels of deep-draft ports, as well as dredging in other ports and by private parties. The amount of new-work dredging varies from year to year, depending on the commercial need for extended navigation facilities and the level of congressional appropriations. From through , a total of MCY was dredged for new construction Most new-work dredging is associated with large federal projects. To qualify as a federal projectâ€"approved by U. Port upgrades also benefit the nation as a whole by supporting trade, an important element of the U. Foreign trade now accounts for 20 percent of the gross domestic product GDP , and this percentage is expected to grow in the future Interagency Working Group on the Dredging Process, The combined economic impact of U. The demand for waterborne cargo initiates a chain of activity that contributes to the national economy. S ports handled approximately 2. The status of the fund was unclear as of late ; the U. Court of International Trade has ruled that the tax on exports is unconstitutional. The government, which claims the tax is actually a user fee, was expected to appeal the decision. Page 22 Share Cite Suggested Citation: Contaminated sediments and associated management difficulties can impede the expansion of navigational capacity and impose economic penalties. The most elemental form of risk assessment is intended to determine whether the concentrations likely to be encountered by organisms are higher or lower than the level identified as causing an unacceptable effect. In this context, an effects assessment is a determination of the toxic concentration and the duration of exposure necessary to cause an effect of concern in a given species. Risk is discussed in other reports of the NRC b, a,b, a,b,c, , and , which address broad issues linking risk, science, and policy. Risk management is the evaluation, selection, and implementation of alternative methods of risk control. Contaminated sediments are considered a problem only if they pose a risk above a toxicological benchmark, or acceptable level, which can be identified through a risk assessment. These challenges are outlined here to lay the groundwork for the analysis in forthcoming chapters First, management strategies must be identified that reduce risk to the benchmark value. The values currently used as benchmarks are imperfect in that they are based on inconsistent or incomplete applications of risk assessment principles as discussed in chapters 2 and 3. Second, remediation technologies must be identified that can reduce the risk associated with contaminants to acceptable levels sometimes known as "environmentally acceptable end-points" 7 within 6 The application of the risk assessment process to environmental or cleanup dredging has been summarized by the USACE Imminent health or environmental risks may call for prompt interim action and, later, more complete remediation. Where initial risk levels warrant some action but are not critically high, slower remediation tactics, such as natural recovery, may be appropriate. The capabilities of the various remediation technologies for reducing risk can only be estimated see Chapter 5. Third, promising alternatives must be evaluated within the context of making trade-offs among risks, costs, and benefits. This is a difficult process, due in part to the uncertainties of risk and cost estimates. Fourth, the trade-offs must be communicated effectively to the stakeholders who have a say in the allocation of resources and an interest in ensuring that the decision-making process results in the successful resolution of the problem. The contaminants of concern include trace metals and hydrophobic organics, such as dioxins, polychlorinated biphenyls PCBs , and polyaromatic hydrocarbons. Metals bind to mineral surfaces or are present as sulfide precipitates. Because of the physiochemical state of the hydrophobic organics, they tend either to sorb to natural organic matter and fine clays or to be partitioned into a separate liquid phase, such as oil or coal tar.

CONTAMINATED SEDIMENT REMOVAL PROGRAM pdf

8: Contaminated Sediments | Great Lakes | US EPA

Sediment contamination is a significant liability for the Department of Defense (DoD), with overall liabilities estimated to approach $2 billion.

Mention of trade names or commercial products does not constitute endorsement or recommenda- tion for use by USEPA or any of the contributing authors. Jan Miller of the Corps North Central Division coordinated the preparation of this report and was the technical editor. Ojas Patel, of the Corps North Central Division, contributed editing and technical support throughout the production of the document. David Cowgill and Dr. Principal authors of chapters of this document were: Dave Wong, Corps Detroit District, Chapters In addition to those provided by the principal and contributing authors, comments from the following reviewers aided greatly in the completion of this document: This document presents guidance on the planning, design, and implementation of actions to remediate contaminated bottom sediments, and is intended to be used in conjunction with other technical reports prepared by the ARCS Program. Sediment remediation may involve one or more component technologies. In situ remedial alternatives are somewhat limited, and generally involve a single technology such as capping. Some technologies, such as dredging and confined disposal, have been widely used with sediments. Most pretreatment and treatment technologies were developed for use with other media i. The feasibility of applying treatment technologies to contaminated sediments is influenced by the chemical and physical properties of the material. Bottom sediments commonly contain a variety of contaminants at concentrations far below those at which treatment technologies are most efficient. The evaluation of sediment remedial alternatives should consider their technical feasibility, contaminant losses and overall environmental impacts, and total project costs. This document provides brief descriptions of available technologies, examines factors for selecting technologies, discusses available methods to estimate contaminant losses during remediation, and provides information about project costs. The level of detail in the guidance provided here reflects the state of development and use of the various technologies. This report should be cited as follows: Superfund framework for evaluating contaminated sediments. Approaches for evaluating potential remedial alternatives. Decision-making framework for evaluating remedial alternatives. Example of a complex sediment remedial alternative. Potential contaminant loss pathways from a confined disposal facility. Cross section of in situ cap used in Sheboygan River. System for injecting chemicals into sediments. In situ treatment application using a sheetpile caisson. General types of commonly used dredges. Specialized mechanical dredge buckets. Typical design of a center-tension silt curtain section. Typical configuration of silt curtains and screens. Examples of chutes used for transporting dredged material. Example sediment remedial alternative using various transport technologies. Unit costs for pipeline transport of selected dredged material volumes. Unit costs for tank barge transport of selected dredged material volumes. Unit costs for rehandling and hopper railcar transport of selected dredged material volumes. Unit costs for rehandling and truck trailer transport of selected dredged material volumes. Unit costs for rehandling and belt conveyor transport of selected dredged material volumes. Example multiunit pretreatment system. Distribution of selected contaminants in Saginaw River sediments. Diagram of an incineration process. Diagram of a thermal desorption process. Diagram of an immobilization process. Diagram of an extraction process. Biodegradation potential for classes of organic compounds. Diagram of an aerobic bioslurry process. Diagram of a contained land treatment system. Placement methods for unrestricted, open-water disposal. Examples of level-bottom capping and contained aquatic disposal. Control systems for selected landfills. Framework for testing and evaluation for open-water disposal. Framework for testing and evaluation for confined disposal. Surface area and dike height required for hypothetical , yd3 76, m3 -capacity confined disposal facility for mechanically dredged sediments. Surface area and dike height required for hypothetical , yd3 76, m3 -capacity confined disposal facility for hydraulically dredged sediments. Capital costs for a hypothetical confined disposal facility assuming hydraulic dredging and disposal. Construction contract costs January for Great Lakes confined disposal facilities. Confined disposal facility with cross dike. Cross section of a confined disposal facility dike with a filter layer. Cross section of an in-dike filter cell. Hypothetical sediment remediation facility.

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