Planning & **Implementing**

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Overview of a Dredging Project

A hydraulic dredge operation in a cove of dense aquatic plants, pumping the dredge slurry to the settling basins.

Planning and implementing a dredging project at a sediment-impaired recreational and/or water supply lake is often one of the most significant and costly management efforts that a lake association, park district, or municipality will be required to undertake during its lifespan. The reasons for initiating a planning effort for dredging include observed problems such as excessively shallow water depths that present navigational hazards, increased turbidity and algal blooms occurring throughout the lake, aquatic and terrestrial vegetation growth in shallow bars and emerging deltas near tributary inflow points, and the increase and even dominance of rough fish such as common carp. A successfully completed project can provide long-lasting benefits that include increased water depths, restored water storage capacity, enhanced aquatic habitat, a more balanced fish population, and improved water quality and clarity. Therefore, it is extremely important to gather the information necessary to determine whether or not a dredging project is actually required, the extent of the sediment-impaired area of the lake, the quantity of sediment to be removed, the physical and chemical characteristics of the sediment, the method of removal, where it could be placed for storage and dewatering, and how much the potential project would cost.

Sedimentation Survey

The first step in the planning process should be the completion of a sedimentation survey in order to measure existing water depths and the sediment deposition layer overlying the harder, original lake bottom. The optimum approach would include obtaining these measurements along predetermined transects or cross-section lines strategically located throughout the lake and generally running perpendicular to the longitudinal alignment of the lake and inlets, or as close to perpendicular as possible. Easily recognizable features that can be located using geo-referenced aerial photography and GPS technology are a good starting point for laying out a suitable network of transects for morphometric and cross-sectional analysis. Sediment depths are determined by probing through the sediments using jointed steel rod sections that can penetrate accumulated sediments but cannot penetrate the harder original lake bottom. In addition to allowing sediment volumes to be quantified, these data provide a three-dimensional view of the sediment deposition layer within each lake segment in relation to water depth. Evaluating these relationships makes it possible to prioritize sediment removal areas, volumes, and target depths.

Sediment Characterization

In addition to understanding the distribution and magnitude of the accumulated sediment, it is necessary to physically characterize the physical and chemical properties of the sediment, not only to satisfy various state and federal regulatory requirements, but to utilize in the planning and design process. Depending on the method of sediment removal considered for a project (i.e., mechanical or hydraulic), analyses such as particle size distribution, water content, dry bulk density, and settleabilty are vital to understand how the sediment will behave when handled, pumped, impounded, dewatered, stored, and reused. Fine-grained sediment hydraulically pumped through a pipeline into a sediment dewatering facility can require long periods of time to settle and become sufficiently clarified for discharge back to the receiving waterway, which preferably drains back to the dredged lake, to maintain operational water levels. When fine-grained and/or organic sediment does not settle to acceptable regulatory limits for total suspended solids (TSS) within a 24-hour period, an ecologically friendly polymer or flocculent is generally required to accelerate the settling process. When a conventional earthen dewatering site cannot be located, alternative storage and dewatering approaches must be evaluated, such as geotextile tubes (Geotubes), on-site mechanical dewatering systems, and phased construction that includes periodic facility cleanout for storage maintenance.

Design and Permits

Once preliminary planning data have been acquired and the extent of the sediment has been adequately quantified and characterized, estimates of probable cost can be developed, potential storage and dewatering sites can be evaluated and selected, and tangible plans can be made to proceed with designing, permitting, the development of bid plans and specifications, and, ultimately, implementation of the sediment removal project. Although regulatory permitting requirements vary from state to state, particularly with respect to the allowable level of total suspended solids in the effluent discharge for a hydraulic dredging project, most state and federal regulations require a multi-agency Joint Application Permit that includes a description of where the project is located; how it will be completed; a summary of the physical and chemical characteristics of the sediment to be removed; an Anti-Degradation Assessment for the EPA Section 401 Water Quality Certification; an EPA NPDES Stormwater Permit; a Phase 1 Archeological Survey to confirm that no significant cultural resources will be impacted; and a Dam Construction and Operating Permit, depending on storage impoundment size, capacity, and proximity to infrastructure.

Proper collection and testing of the sediments is critical to a successful project.

The design phase of the project will generally include selection and acquisition of an appropriately sized sediment storage and dewatering facility. The method of dredging can be a factor in sediment storage site selection, but hydraulic dredging is generally more efficient and cost-effective than mechanical excavation for larger-sized projects, particularly when the watershed is extensive or where the lake is used as a public water supply source. When a sediment storage and dewatering facility is required for a hydraulic dredging project, a topographic survey and a geotechnical investigation must be completed in order to design the earthen impoundment, which often can require a dam construction and operating permit to insure that the temporary impoundment is designed with a sufficient safety factor. If an earthen impoundment breaches suddenly due to poor design and construction methods, the resulting breach wave can be quite destructive and can impact public property and safety.

In addition to the topographic and geotechnical requirements, the design and layout of the sediment dewatering facility

A hydraulic dredge pumps material to a settling basin (top right).

(SDF) must maximize retention time for optimum solids settling; and should be sized to accommodate an anticipated sediment bulking factor that occurs when an in-situ volume of sediment is mixed with water and pumped as slurry though a pipeline before being discharged into the SDF. Since most recreational and/or public water supply lakes do not have elevated concentrations of hazardous pollutants, additional treatment and handling of the sediment and discharge water other than the use of polymers or flocculants is generally not necessary. When the sediment in a lake located near an industrialized area is confirmed to have elevated contaminants, the cost of dredging can increase dramatically.

Dredging slurry exits the pipe at the settling basin.

Summary

In summary, a well-planned project with a clearly presented set of plans and specifications prepared by an experienced consultant, allows qualified dredging contractors to submit competitive bids, often resulting in a more successful and cost-effective project.

For more information about planning a dredging project, see *Restoration and Management of Lakes and Reservoirs* (third edition, 2005) by G. Dennis Cooke, Eugene B. Welch, Spencer A. Peterson, and Stanley A. Nichols.

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