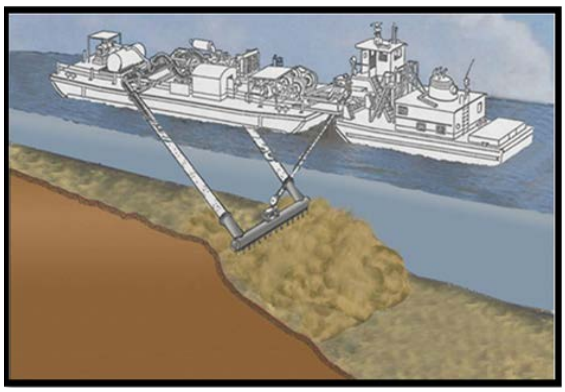
Innovative Sediment Management Technologies for Channels and Reservoirs

Dredging Operations Environmental Research Program (DOER)

U.S. ARMY CORPS OF ENGINEERS BUILDING STRONG®

Problem

Navigation dredging budgets have not kept pace with the increasing costs. New methods, such as water injection dredging (WID) and bedload interception technologies (BI-T), are needed to reduce unit dredging and disposal costs of dredged volumes. With the right conditions, WID is a cost-effective alternative that is specifically designed to excavate fine-grained (soft) sediments without requiring dredged material transport equipment or a placement site. However, WID application is limited, in part, due to a poor understanding of sediment, bed slope, and hydrodynamic conditons under which this method can effectively be applied. With development of the range of conditions for effective application, WID can also be applied as a method to bypass sediment through reservoirs with low elevation discharge conduits and maintain reservoir capacity. BI-T captures the coarse sediment fraction in the bedload near the mouths of their sources such as creeks and small rivers, which can reduce localized shoaling that require frequent, expensive removal to maintain safe naviation. However, BI-T has not been proven as sustainable solutions to reduce dredge volumes and costs.



Study Description

USACE requires evaluation techniques that will identify sites for cost-effective WID and BI-T applications. This research task will develop evaluation tools and guidance to implement cost-effective WID and BI-T applications to sustainably maintain navigation channels and reservoir capacity. Specifically, this research task will develop data sets that will be used to create a screening level matrix against which site specific sediment properties can be compared and fluidization potential inferred. Secondly, sediment processes measurement equipment and a transport model will be developed that can be applied at specific sites to further demonstrate WID applicability for sediments that pass the screening level evaluation. Results from this tiered analysis will provide project managers with decision support tools that can expand application of cost effective WID. This research task will also foster the required industry/government collaboration to facilitate infrastructure construction necessary for WID application in channels and reservoirs. In addition, this research task will also document application of BI-T at sites in the US and develop engineering guidance for application at other sites to reduce channel and reservoir infilling.

Products

Products include screening data bases, sediment fluidization measurement tools, and predictive models of fluidized sediment transport required to evaluate a priori whether a site is suitable for WID application. The data bases will be used as a first step, applied as a screening level analysis, to identify sediments for potential WID application based on measured sediment properties. The measurement tools can then be applied to verify fluidization potential for site-specific sediments. The predictive model will then evaluate the transport potential and direction. These components, used in combination, will provide project managers with confidence that cost-effective WID can be applied in their channels or reservoirs. In addition, detailed case studies of BI-T projects will be produced (including planning, permitting, design, operation, maintenance requirements, and respective performance metrics) and engineering guidance provided to facilitate increased BI-T use as a sustainable sediment management technique in navigation channels and reservoirs.

Summary

Understanding the potential for WID to fluidize sediments and the conditions under which these fluidized sediments will move as a density current are key to broader application of WID to maintain navigation channels and restore reservoir capacity. If properly applied, WID provides a cost-effecitve method to remove sediments from sites with inadequate or expensive placement alternatives. Demonstration of WID potential will foster the development of the required WID infrastructure to expand WID application in the United States. Another means to reduce dredging costs is sand/gravel trapping. BI-T technologies provide the opportunity to reduce shoaling by preventing bedload sediment from entering channels and reservoirs at the source, typically creeks, arroyos, and small rivers.

Balancing operational and environmental initiatives and meeting complex challenges of dredging and dredged material placement in support of the navigation mission.

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