US Army Corps of Engineers®
Engineer Research and Development Center

Sedimentation Analysis

Description

Sedimentation analysis involves the study of sediments and the mechanisms by which they are transported, eroded, and deposited. The U.S. Army Engineer Research and Development Center's (ERDC's) Coastal and Hydraulics Laboratory (CHL) is involved in a number of estuarine and riverine studies dealing with such areas as: the transport, erosion, and deposition of sediments; behavior and characteristics of sediment beds; analysis of sediment composition for specific applications; evaluation of sediments to determine dredging needs; and forecasting of erosion and/or deposition. These studies are required primarily by U.S. Army Corps of Engineer Districts. Sediment studies can take the form of numerical modeling studies or desktop studies. Numerical modeling studies assess the effects on sedimentation of implementing a proposed alteration to a particular study area, or system. For example, before a channel is deepened, researchers would look at how it would affect shoaling or erosion of the system. Questions they would try to resolve might include whether the harbor would be harder to maintain after completion of the project; if it would damage the shoreline; or what would be the environmental impacts of sediments being deposited in the area or removed from it. A desktop study is a less computationally-intensive method of evaluating changes in sediment erosion and deposition by analyzing the composition and cohesiveness of the sediments present in a specific area and arriving at a prediction of sediment deposition and/or erosion based on these characteristics and traditional mathematical computations. Desktop studies are site-specific and more limited in scope than a numerical model, yet they are a reliable and less costly tool for many applications.

Capabilities

Researchers at CHL conduct 2-D or 3-D multidimensional numerical modeling studies; desktop studies; model development; data collection and analysis.

Supporting Technology

Computational fluid hydrodynamics using physics-based numerical computer models in which equations are based on Newton's laws of movement and acceleration; visualization capabilities such as the Surface-Water Modeling System which allows the user to set up, analyze, and visualize the coastal and inland waterways and wetlands areas; sediment sampling instruments and equipment; and a sediment laboratory facility located at CHL that takes physical samples for evaluations.

Benefits

Analysis of sediments is remarkably useful to evaluate modifications to a system and to determine ways to mitigate any adverse effects. A numerical model can identify likely sediment pathways and sediment erosion/deposition areas. In turn, decision makers are better equipped to establish courses of action. For example, if deepening a channel is expected to increase deposition in an area that would be adversely affected by such an increase in sediment, a sediment trap may be designed at a suitable location to reduce the sediment making its way into that particular location. By analyzing circulation patterns and the characteristics of sediments in the area, likely locations for such a mitigation measure are pinpointed. On the other hand, desktop studies are very well suited to evaluate dredging needs in light of a proposed plan. Taking our channel deepening example, the purpose of the study could be to assess how much more money, for instance, it would cost to maintain the new configuration. A desktop study can predict future deposition or

erosion trends and make determinations on what the future dredging needs will be for the study area.

Success Stories

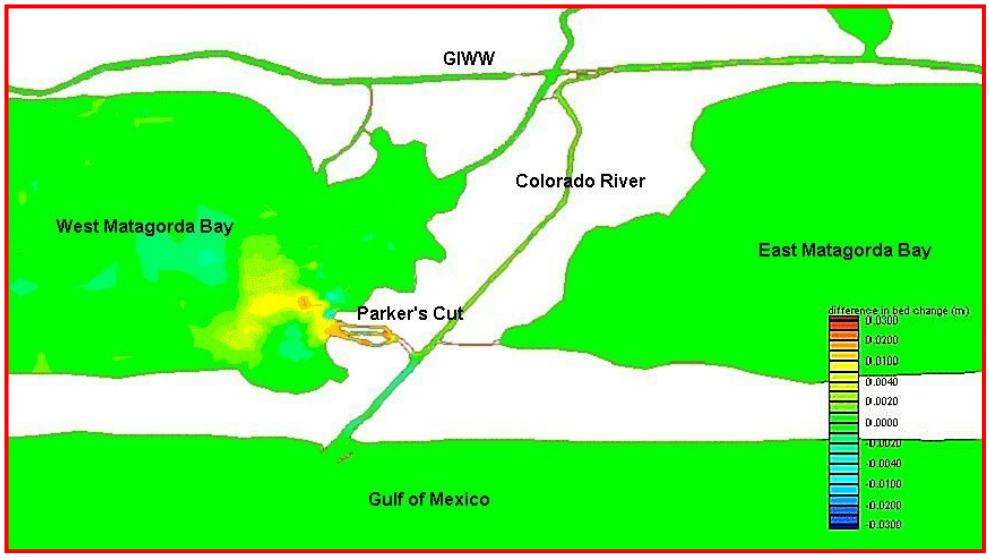
- Contamination containment at Barge Canal along the Ashley River, Charleston, South Carolina. CHL conducted a numerical model to help the Environmental Protection Agency in selecting the best alternative to enhance sediment deposition in the Barge Canal, thereby capping the contaminants and containing them.

Barge Canal Project: Example of sediment model results, accumulation of sediment after 4 days if dikes were placed in front of canal

- Diagnostic Modeling System creation. CHL pioneered a system that combines the strengths of a numerical model and a desktop study, useful for providing sedimentation estimates. The first such application was to evaluate the optimum location for relocating the Gulf Intracoastal Waterway in Matagorda Bay, Texas, that would produce the least amount of sediment shoaling.

- Modeling the fate of dredged material placed at Chesapeake Bay Site 104. An investigation is being conducted to reopen this open water disposal site for dredged material from upper bay navigation channels. CHL is evaluating the potential for dredged material to leave the site and the effect on water quality. Results from the study show a potential for in excess of 10 percent of the material placed there to leave the site or subsequently be eroded. Simulations over the proposed five years of placement show no significant impact on the water quality of the bay.

- Mouth of Colorado River navigation improvements study. A numerical model of East and West Matagorda Bay developed at CHL has aided in the evaluation of several proposed alternatives to improve navigation at the intersection of the Gulf Intracoastal Waterway and the Colorado River Bypass Channel in Texas. Potential effects on sediment pathways and rates of erosion and deposition were assessed for all the options considered, while mitigation measures were recommended for those alternatives yielding unfavorable sedimentation patterns in certain areas.



Mouth of Colorado River Project: Example of sediment model results, effect on sedimentation from opening Parker's Cut for 1 year

Point of Contact

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