New Options for Dredging in Barataria-Terrebonne

Demonstrating Practical Tools for Watershed Management Through the National Estuary Program

Barataria-Terrebonne Basins, Louisiana

Characteristics:

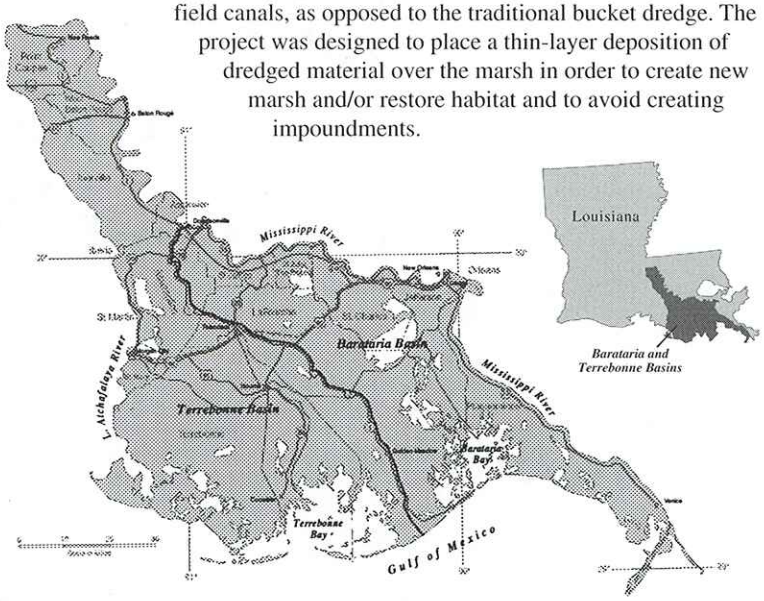
- The Barataria-Terrebonne Estuary includes over 4.1 million acres of wetlands, waterbodies, farmlands, and forests in 15 Louisiana parishes. Approximately 602,000 people live and work within its boundaries. The area contains a multitude of natural and man-made waterways, providing water access for industries such as oil and gas production and shipping.
- The wetlands surrounding the estuary are being lost at the remarkable rate of 21 square miles per year (one half-acre every 15 minutes). Extensive characterization and modeling of the Estuary and its wetlands as part of the Barataria-Terrebonne National Estuary Program has shown that one of the major causes of wetlands loss has been human modification of the hydrology of the system through such actions as construction of navigation canals and levees.
- Thousands of cubic yards of material are dredged throughout coastal Louisiana every year for the maintenance of oil and gas canals and navigation channels. The majority of this material is either prop-washed or placed on existing levees of dredged material in a manner not conducive to the propagation and enhancement of adjacent marsh vegetation.
- One of the most common methodologies employed by public and private entities for displacing dredged material is the use of bucket dredges, with which sediments are dug out and placed on the shore adjacent to the water body. The levees created with this dredged material, sometimes called "spoil banks", form impoundments or otherwise impede natural sheet flow hydrology.

The Problem:

The extensive wetland losses appear to be exacerbated by disruptions to the natural hydrology of the system. Impoundments, produced by dredged material levees, block water flow over land between marsh and water. They also disrupt the critical process of sedimentation on the surface of the marsh from tidal flooding.

The Project:

The purpose of the Alternative Dredging and Spoil Deposition Project was to determine the costs and benefits, both economic and environmental, of using a small hydraulic dredge for maintenance of oil field canals, as opposed to the traditional bucket dredge. The project was designed to place a thin-layer deposition of dredged material over the marsh in order to create new marsh and/or restore habitat and to avoid creating impoundments.



The National Estuary Program

Estuaries and other coastal and marine waters are national resources that are increasingly threatened by pollution, habitat loss, coastal development, and resource conflicts. Congress established the National Estuary Program (NEP) in 1987 to provide a greater focus for coastal protection and to demonstrate practical, innovative approaches for protecting estuaries and their living resources.

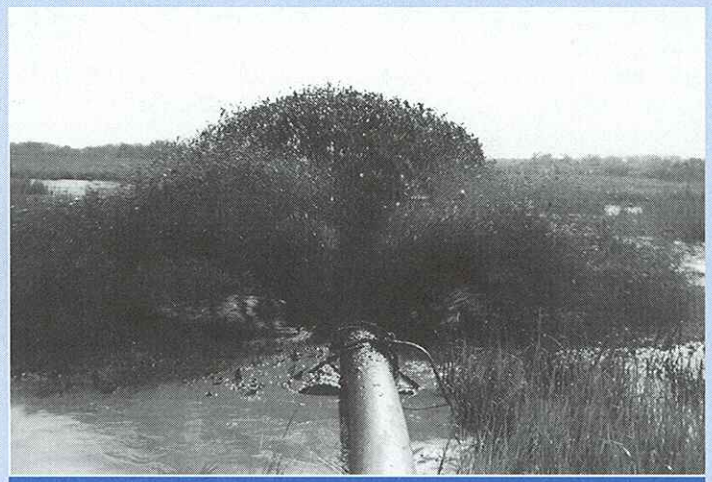
As part of the demonstration role, the NEP offers funding for member estuaries to design and implement Action Plan Demonstration Projects that demonstrate innovative approaches to address priority problem areas, show improvements that can be achieved on a small scale, and help determine the time and resources needed to apply similar approaches basin-wide.

The NEP is managed by the U.S. Environmental Protection Agency (EPA). It currently includes 28 estuaries: Albemarle-Pamlico Sounds, NC; Barataria-Terrebonne Estuarine Complex, LA; Barnegat Bay, NJ; Buzzards Bay, MA; Casco Bay, ME; Charlotte Harbor, FL; Columbia River, OR and WA; Corpus Christi Bay, TX; Delaware Estuary, DE, NJ, and PA; Delaware Inland Bays, DE; Galveston Bay, TX; Indian River Lagoon, FL; Long Island Sound, CT and NY; Maryland Coastal Bays, MD; Massachusetts Bays, MA; Mobile Bay, AL; Morro Bay, CA; Narragansett Bay, RI; New Hampshire Estuaries, NH; New York-New Jersey Harbor, NY and NJ; Peconic Bay, NY; Puget Sound, WA; San Francisco Bay-Delta Estuary, CA; San Juan Bay, PR; Santa Monica Bay, CA; Sarasota Bay, FL; Tampa Bay, FL; and Tillamook Bay, OR.

Introduction to Barataria-Terrebonne

The Barataria-Terrebonne Estuary lies between the Mississippi and Atchafalaya Rivers in south central Louisiana. It is rich beyond imagination in natural resources and cultural heritage, and provides billions of dollars of revenue to the region, the State of Louisiana, and the nation through industries such as commercial fishing, trapping, agriculture, tourism, shipping, and oil and gas.

Unfortunately, the Barataria-Terrebonne Estuarine System is facing a serious crisis. This nationally significant area is experiencing land loss at a faster rate than any other region in the nation, about 21 square miles per year. This translates to about one half-acre every 15 minutes. Studies have shown that over 445,000 acres of marsh converted to open water between 1932 and 1990, and conservative estimates are that an additional 163,000 acres of land will be lost by the year 2010.



The discharge from the hydraulic dredge pumps a slurry of bottom sediments onto the face of the marsh.

The lowland swamps, marshes, and low ridges of Barataria-Terrebonne were built by accumulating Mississippi River sediment. As the river flowed through the area, it deposited sediment in deltas and during flood stages, deposited sediments on the surface of the wetlands themselves. Marsh plants quickly invaded these newly formed lowlands.

Periodically, the river would change course and find a shorter pathway to the Gulf. Without the continuing riverine deposits, soft marsh sediment compacted and the land sank below sea level. Meanwhile, new land built up along the repositioned channel. Before human intervention, sinking land in one spot was replaced with new land somewhere else.

Today, the rivers carry less sediment than a century ago. Additionally, levees constructed to prevent flooding funnel the flow straight to the Gulf where most of the sediment is lost in deep water. Consequently, new land is not forming. Additionally, impoundments resulting from dredging activities prevent sheet flow across the wetlands, precluding sediments from maintaining existing wetlands.

Over the previous century the Barataria-Terrebonne marshes have been criss-crossed with channels to accommodate navigation and the oil and gas industries. In order for these revenue-generating industries to continue to thrive, waterways must be maintained at sufficient widths and depths. This is typically accomplished through maintenance dredging, most often done with bucket dredges. The dredged material is placed on the marsh along the edge of the canal, forming levees which block the natural sheet flow of water, and sediments, over the marsh surface. Additionally, the material covers, and ultimately kills, the existing marsh vegetation.

When they become extensive enough, the levees form impoundments on the surface of the marsh which prevents sediments from reaching the marsh surface and maintaining its elevation. The impoundments can also flood from storm overwash or rising ground water which leads to standing water which also will kill marsh vegetation. This combination of loss of sediment and standing water leads to marsh compaction and loss of wetlands. Studies have shown that there is a direct correlation between the existence of canals, dredged material levee density, and land loss. Local erosion is often isolated around the levees or within areas partially or wholly impounded by them. For this reason, the Barataria-Terrebonne National Estuary Program believes that it is important to promote alternative techniques that will beneficially use dredged material to enhance adjacent marsh areas.

The amount of dredging done within the estuary (over 22 million cubic yards of material have been dredged in Lafourche Parish alone in the past fifteen years) and the resulting levees and impoundments make this a significant aspect of wetland loss.

Overview of the Demonstration Project

Is hydraulic dredging a viable alternative to bucket dredging? Do the benefits outweigh the costs? Can new marsh be created by thin-layer deposition of dredged material over marshes? The Barataria-Terrebonne National Estuary Program thought so, but wanted to investigate.

Scientists recognize hydraulic dredging as a viable alternative to bucket dredging. This alternative has fewer detrimental impacts and is recognized as producing a more beneficial use of dredged material. Pumping fluidized dredged material over the marsh, rather than concentrating it in a levee, reduces the effects and degree of impoundment and in many ways mimics the natural deposition of sediment from river flooding. The

hydraulic operation involves pumping dredged material from canal or channel water bottoms to a nearby containment area. Containment areas in shallow water require the construction of a minimal retention levee to hold slurry material until the water drains or evaporates out of the contained area.

Project Objectives

The purpose of the Action Plan Demonstration Project was to compare the costs and benefits of using a small hydraulic dredge for maintenance of an oil field canal and placement of material in a thin-layer deposition in order to create new marsh and/or restore habitat.

Implementing the Project

To achieve the project's objectives, Texaco, Inc. and the Barataria-Terrebonne National Estuary Program entered into an agreement with the Lafourche Parish Coastal Zone Management Program for project design and implementation. Eight potential sites for deposition of dredged material were identified in the Leeville field in Lafourche Parish, Louisiana. The field is highly active with a number of canals and sections of deteriorating marsh sites. The sites vary in size, depth, percent of vegetation coverage, and degree of impoundment.

Soil investigations found them to be a "Timbalier-Belle Pass associate" characterized by very fluid organic soils overlying a very fluid clay. A pre-construction over-flight provided current aerial photos of the area. The Parish subsequently entered into a professional service contract with Picciola and Associates, Inc. for surveying, technical specifications, advertisements, and administrative aspects of the project and contracted with Grillot Company, Inc. to dredge 26,600 cubic yards of material and deposit it onto four sites.

Before dredging commenced, retention levees were built, as needed, using a marsh buggy elevator, and monitoring stations were constructed by the National Biological Service of Lafayette, LA. The data to be obtained included: thickness of dredged material after deposition, diversity, compaction of the material over time, subsidence of pre-dredge pond bottom over time, subsidence over vegetation vs. subsidence over pond bottom, and changes of plant diversity/abundance/ biomass over time as related to change in sediment cover.

The dredging itself took eight days to complete. The dredge, "Crown Point", was 85 feet in length and 24 feet wide and required a 4.5 foot draft. It had a 42-inch cutter head and could potentially dredge to a depth of 38 feet and discharge to a distance of 3,500 feet without a booster station. The dredge discharged at a 200 yd3/hr. rate through a 12-inch effluent line.

Success Stories

Although the project was designed to do a cost comparison of hydraulic vs. bucket dredging, it also provided the opportunity to study and determine if the environmental benefits of utilizing the bucket dredge method outweigh the additional costs. Monitoring of sites was conducted in June and October of 1996, and the sites were visited in January and March of 1997. A preliminary analysis of a small portion of the data collected at three ponds in Leeville, LA provided an indication of the amount of material accumulated and the levels of subsidence occurring. This admittedly preliminary analysis suggested that the deposited material did compact as expected. The material enhanced the sites and created new marsh in areas that were formerly covered by water. Existing vegetation appears to be thriving, and sprouting vegetation is visible throughout.

A year after dredging, new marsh growth is evident.

The project has shown that hydraulic dredging is a viable alternative to bucket dredging and can be effective not only in enhancing existing marsh but also in creating new marsh.

The Barataria-Terrebonne National Estuary Program believes that it is important to promote the use of hydraulic and other alternative dredging techniques that will beneficially use dredged material to enhance marsh areas. Thin layer deposition is one method that has fewer detrimental impacts than bucket dredging techniques and reduces the effects and degree of impoundment. Alternative techniques need to be explored as well. The costs associated with the dredging work may be slightly higher, at least initially, but the environmental benefits outweigh the costs in the eyes of many.

Lessons Learned

Although the project's cost comparisons showed that, in this instance, the hydraulic dredge technique was more expensive than the bucket dredge method ($1.96 per cubic yard versus $.91 per cubic yard), several important factors were revealed:

- To date, the use of hydraulic dredge operations in South Louisiana has been infrequent. This factor has two important effects on the cost of the beneficial use technique—economists agree that the lack of competition increases the price and a lack of equipment and experience with small hydraulic dredges in the oil and gas field contributes to the higher cost. It is predicted that if this technique becomes more widely used, the per unit cost would decrease.

- Hydraulic dredging technology may provide opportunities for the public and private sectors to work together to achieve beneficial use of dredged material in a coordinated effort that would assist public goals of wetland creation and coastal restoration. Cooperative agreements can be sought to share costs associated with hydraulic dredge work.

- Coastal Use Permit applicants could reduce the amount of off-site mitigation required for habitat damage caused by their dredging activities by beneficially using the material to restore or create marsh habitat. In cases where applicants create more wetland values with dredged material than they alter by dredging, they would be eligible to receive advanced mitigation requirements for future projects. Such opportunities would promote cost savings in mobilization and demobilization by having fewer, larger projects utilizing equipment already on-hand.

For further information, contact:

Ms. Tanya Matherne,
Barataria-Terrebonne National Estuary Program
Nicholls State University
P.O. Box 2663
Thibodaux, LA 70310

1-800-259-0869
Fax (504) 447-0870

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