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ABSTRACT

This project is focused on the dredging impacts on the water quality and biogeochemical processes in two Louisiana sediment borrow areas, namely Sandy Point and Caminada pits. Vessel-based water sampling, tripod, geophysical, and 3-D numerical modeling methods are used to capture the temporal and spatial variations both inside and outside two dredge pits. Our results increase BOEM's decision making ability (e.g., hypoxia frequency and duration, impact of dredge depth to hypoxia development, pit impact to surrounding water) regarding the development of a monitoring program and provide for better management of valuable sand resources.

BACKGROUND

Coastal nourishment projects place a strong demand for large quantities of sand for barrier island restoration and mud for marsh creation. Dredging processes result in unnatural pits and studies have

shown these pits may directly or indirectly affect local and adjacent environments. This is a concern for scientists, engineers, and decision makers, especially with the implementation of further dredging operations in the northern Gulf of Mexico. Environmental consequences of dredging include alterations of seabed characteristics, morphodynamics, and hydrodynamics which impact water quality and biological communities.

OBJECTIVES

This project leveraged resources from previous projects and expanded upon the effects that physical changes may have on hydrodynamics, water quality, and biogeochemical processes at Caminada and Sandy Point dredge pits. The primary goal of this study was to observe the early stages of post dredging impacts on sediment transport, water quality and biogeochemistry.

METHODS

There are two main study areas in this project: inside and outside of Sandy Point dredge pit and inside and outside of Caminada dredge pit. Major methods include vessel-based water sampling and profiling, tripod, geophysical as well as numerical modeling work.

RESULTS

Bottom waters inside Caminada dredge pit experienced fewer variations in water masses, lower dissolved oxygen conditions, and lower suspended sediment concentration when comparing to outside Caminada pit throughout the tripod deployment. Sediment infilling at Caminada dredge pit is not dominated by ambient Ship Shoal sand, as there is an evident lack of sand within the infilled material of the interior of the dredge pit. Mainly fine to medium silts are deposited within this dredge pit, punctuated by laminations of coarser silt with few very fine sand laminations. Based on the presence of sediments containing 7Be and grain size analysis of the cores, it was determined the sediments within this sandy dredge pit are sourced from a combination of the Atchafalaya and Mississippi River plumes. Seasonality did not widely affect dredge pit conditions, but there were differences in sediment oxygen consumption between the inside and outside stations of Caminada and Sandy Point pits. Caminada sediment oxygen consumption data demonstrated significant differences between inside and outside stations. The sediment oxygen consumption rates at Sandy Point did not show statistically significant differences between inside and outside stations.

CONCLUSIONS

The setback buffer distance from pits to oil/gas infrastructure currently being used by BOEM ranges from 500 feet for wells to 1,000 feet for pipelines. Our results show that the pit walls of both Caminada and Sandy Point pits were relatively stable. Due to its cohesive nature, paleo river channel dredge pits (like Sandy Point) have stable pit walls with minimal migration. As shown in this study, hypoxic conditions were found in both Caminada and Sandy Point pits. The impact of low oxygen on benthos should be monitored continuously so that the recovery of benthos over time can be tracked. Sediment oxygen consumption, total organic carbon, phytoplankton biomass and its dominant taxa, microphytobenthos and its dominant taxa, as well as nutrients are key biological and chemical parameters/data in the dredge pit areas. In this project, parameters were mainly collected in spring and summer in Caminada pit in one year and in spring and summer in Sandy Point pit in another year. It is recommended that parameters in all four seasons of the whole year should be collected so that the impacts from physical parameters (like temperature, stratification, river discharge, winds, waves, and pit infilling) can be fully captured.

STUDY PRODUCT(S)

Bales R, Xu K, Li G, Maiti K, Liu H. 2021. Hydrodynamics, sediment transport, and water quality of two contrasting dredge pits on the Louisiana shelf. Cont Shelf Res. 230, 104569.

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Xu K, Maiti K, Bargu Ates S, Bentley S, White J, Wilson C, et al. 2023. Development of a monitoring program for water quality and biogeochemical processes of Louisiana sediment borrow areas. New Orleans (LA): US Department of the Interior, Bureau of Ocean Energy Management. Obligation No.: M17AC00019. Report No.: BOEM 2023-080. 71 p.

Xue Z, Wilson C, Xu K, Bentley S, Liu H. 2021. Sandy Borrow Area sedimentation – characteristics and processes within South Pelto Dredge Pit on Ship Shoal, Louisiana Shelf, USA. Estuaries Coasts. 4. 658-676.

MAP OF STUDY AREA

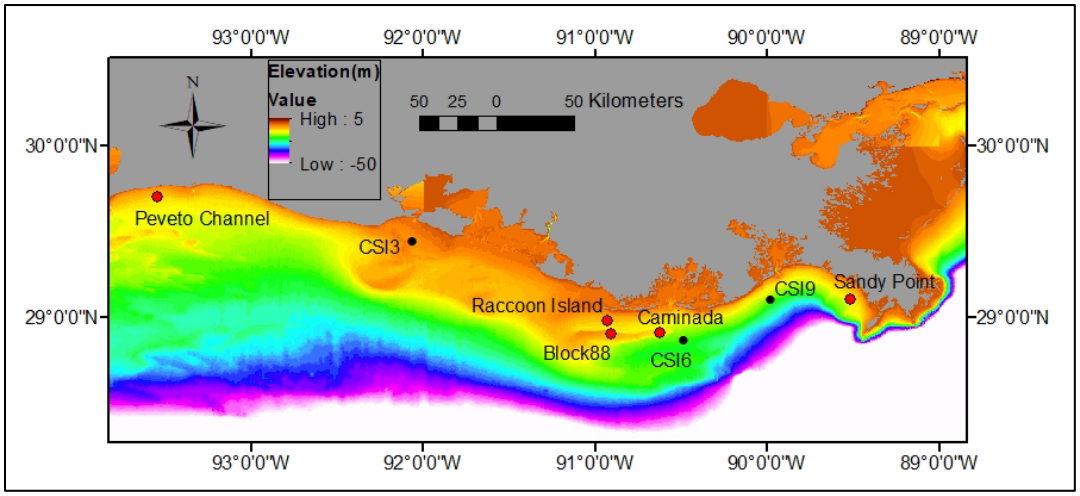

Figure 1. Base map

Map showing the locations of three mud-capped dredge pits at Peveto Channel, Raccoon Island and Sandy Point and two sandy dredge pits at Caminada and Block 88 in Ship Shoal area. Black dots are LSU WAVCIS (wave-current information system) stations, including CSI3, CSI6, and CSI9.