Sediment Transport and Infilling Processes of Mud-Capped Dredge Pits on Louisiana Shelf

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The shelf offshore Louisiana is characterized by a dominantly muddy seafloor with a paucity of restoration-quality sand proximal to shore. Discrete sand deposits associated with ancient rivers that incised the shelf occur close to shore. These shelf channel sands have been targeted for coastal restoration projects resulting in significant cost savings over more distal deposits. Because of contrasting characteristics of cohesive vs. non-cohesive sediment and potential supply from the Mississippi and Atchafalaya Rivers, long term pit evolution is poorly understood. Here we present geophysical and geological data (bathymetry, sidescan, subbottom, and radionuclide of sediment cores) and physical oceanographic observations (hydrodynamics and sediment dynamics) collected at Peveto Channel, Raccoon Island and Sandy Point dredge pits on Louisiana shelf. Vessel-based ADCP profiling data show that spatially there are generally three layers of flow near the dredge pits: the sea surface flow is fast, the middle water column is at an intermediate speed and the flow inside pit is random and sluggish. Bowl-shaped collapse failures and retrogressive stair-stepped slumps are found, and the edges of pit walls are morphologically rough and temporally stable. Differing from sandy pits, it seems that the ‘mud caps’ prevent widespread pit wall collapse and help preserve the localized pit morphology. Those pits are also efficient sediment traps. These field data collections along with pre-existing data provide a time-series to capture pit evolution, and are used to compare with model predictions. Conceptual morphological models are developed for dredge pit evolution and testing effectiveness of setback buffer distances.