APPLICATION OF LABORATORY AND MODELING TOOLS TO DESIGN THIN LAYER PLACEMENT PROJECTS FOR MARSH NOURISHMENT

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ABSTRACT

Thin layer placement of dredged material is experiencing a renaissance, being used to restore degraded marshes. In designing constructed marsh nourishment projects, elevation is critical to optimizing its function. However, as dredged material is placed as a slurry (water and sediment mixture), the dredged material settles rapidly and consolidates to a lower elevation. Placing dredged material to a proper initial elevation so as to achieve a desirable elevation for marsh function over the long term is critical for project success. Laboratory testing and modeling tools are available to predict consolidation for designing thin layer placement projects.

These tools were recently applied to evaluate consolidation at planned and ongoing marsh restoration projects on the U.S east coast using maintenance dredged material from nearby navigation channels. The existing elevation across these marsh sites varies such that the sites consists of relatively deep subtidal pools, intertidal vegetated marsh and predominantly exposed vegetated marsh. Sediments within the channels were sampled and analyzed for geotechnical properties as well as suitability from a contaminant standpoint. Evaluation of the channel sediments showed very different materials within the separate channels, ranging from relatively sandy material to highly organic and fine-grained material. The behavior of these materials with respect to placement and consolidation will be highly variable. Laboratory column settling tests and consolidation testing were used to predict the behavior of each channel material.

Depending on how the material is placed hydraulically, sand is likely to deposit near the pipe discharge, while the fines could be expected to flow away from the pipe, resulting in a range of thicknesses of both sand and fine-grained materials. Sand deposits are expected to undergo very little consolidation while the finer material is expected to consolidate greatly. Conversely, the marsh foundation is expected to undergo measurable settlement from a deposit of sand but very little from a deposit of fine-grained or organic material. The Primary Consolidation, Secondary Compression and Desiccation of Dredged Fill (PSDDF) model was used to evaluate the elevation change over time for a range of placement elevations and thicknesses for the different material types. The subsequent information can be used to predict the resulting landscape in the months or years after placement for a given fill elevation.

Keywords: PSDDF, dredged material, consolidation, thin layer placement, beneficial use

INTRODUCTION

Beneficial use of dredged material for wetlands nourishment and restoration is currently experiencing a renaissance. This resurgence is due, in part, to the diminishing capacity to place or dispose of material dredged from navigation channels, in conjunction with the realization of the deleterious effects that sea level rise is having on wetlands. Marsh nourishment, a subcategory of thin layer placement, is practiced by placing dredged material in thin layers so as to build elevation without smothering existing marsh vegetation. This method allows better coverage and improved recovery times over placement of thicker lifts. A primary goal of marsh nourishment is to build elevation capital. As functional ecological efficiencies of marshes rely on elevation of the placed material, the dredged material thickness, both short-term and long-term, is a fundamental parameter for effective design, construction and maintenance of a sustainable marsh.

In designing constructed marsh restoration projects, it is important to know how much material should be placed initially in order to achieve a functional elevation at some point in the future. Dredged material placed for marsh restoration is typically placed hydraulically as a slurry, which enables the material to be pumped or sprayed across the

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