Alongshore Geomorphologic Evolution of Plumb Beach, New York City

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Introduction

The present-day Plumb Beach is an artificially-created sand barrier, 1.6 km long, located inland of Rockaway Inlet, and co-managed by Gateway National Recreation Area, National Park Service, and the New York City Parks. Its topographical characteristics are responding to tidal currents and altered waves arriving through Rockaway Inlet. In recent decades, in the absence of any new sediment, the central portion of Plumb Beach has undergone erosion and inland shoreline displacement, promoting alongshore mobilization and accumulation of sediment to both ends of the barrier. Most of the transport is directed towards the east, promoting the creation and extension of a 600 m sand spit encroaching onto a marsh habitat. Loss of sediment in the central portion of Plumb Beach is causing damage to the local multi-use path and threatening the adjacent major highways and park infrastructure.

Evolution of Plumb Beach

Plumb Beach is a remnant of the eastern end of the Corey Island barrier island and its associated tidal inlet delta (Psuty et al. 2010). The Rockaway barrier island to the south extended westward during the past several centuries (Taney 1961), eventually shielding Plumb Beach from the ocean waves directly and, dredging of the channel into Sheepshead Bay severed the sediment transport vector toward the present position of Plumb Beach. Creation of the Belt Parkway (late 1930s) promoted placement of fill on the wetlands and short island of Plumb Beach and the establishment of a re-formed shoreline at the seaward margin of the fill. The dredging of the navigation channel to the west of Plumb Beach resulted in the absence of sediment input and net erosion displaced the shoreline inland toward the Belt Parkway. To counter the erosion, several beach nourishment episodes have been carried out in the central portion of Plumb Beach. Additionally, rip-rap material and offshore breakwaters and groins have been placed using old tires to interrupt the incident waves and reduce the energy reaching the beach (USACE and CPE 1994). The most significant beach nourishment project was conducted in 1992, with the placement of 147,000 m$^3$ of sand dredged from the Rockaway navigation dredging of the navigation channel to the west of Plumb Beach resulted in the absence of any new sediment, the central portion of Plumb Beach has undergone erosion and inland shoreline displacement, promoting alongshore mobilization and accumulation of sediment to both ends of the barrier. Most of the transport is directed towards the east, promoting the creation and extension of a 600 m sand spit encroaching onto a marsh habitat. Loss of sediment in the central portion of Plumb Beach is causing damage to the local multi-use path and threatening the adjacent major highways and park infrastructure.

Recent Shoreline Change

The central area of Plumb Beach is the locus of major erosion, about 1,900 m$^3$ (2,500 ytd) annually (USACE and CEP 1994). Exposure to waves entering through Rockaway Inlet is continuing to mobilize the sand in the central portion which is characterized by a narrow beach and low dune topography with a small escarpment (bluff) existing back into the fill (PB5). Some of the sediment is transported into the nearshore in the form of low sand waves propagating alongshore to the east, adding to the distal end of the spit-like barrier. The topography is in extending seaward (PB5 and PB6). Severe erosion is damaging the local multi-use path in several locations and is threatening other aspects of the infrastructure, such as the Belt Parkway. Recent storms (November 2009 and March 2010) have destroyed portions of the multi-use path and the erosion area has extended seaward, promoting cut-back and scarping of the dunes (PB5). Much of the recently-eroded sediment is transferred to the lower beach and the erosion area has extended easterly, promoting cut-back and scarping of the dunes (PB5). Much of the recently-eroded sediment is transferred to the lower beach and the erosion area has extended easterly, promoting cut-back and scarping of the dunes (PB5). Much of the recently-eroded sediment is transferred to the lower beach and the erosion area has extended easterly, promoting cut-back and scarping of the dunes (PB5). Much of the recently-eroded sediment is transferred to the lower beach and the erosion area has extended easterly, promoting cut-back and scarping of the dunes (PB5). Much of the recently-eroded sediment is transferred to the lower beach and the erosion area has extended easterly, promoting cut-back and scarping of the dunes (PB5). Much of the recently-eroded sediment is transferred to the lower beach and the erosion area has extended easterly, promoting cut-back and scarping of the dunes (PB5). Much of the recently-eroded sediment is transferred to the lower beach and the erosion area has extended easterly, promoting cut-back and scarping of the dunes (PB5). Much of the recently-eroded sediment is transferred to the lower beach and the erosion area has extended easterly, promoting cut-back and scarping of the dunes (PB5).

Conclusions

Efforts to supplement the sediment supply of Plumb Beach and to maintain the shoreline position have been attempted several times. However, the conditions of erosion at the central portion of the barrier and transport to the distal margins continue. The erosional trend will persist because of the exposure to the incoming waves through Rockaway Inlet and the lack of sediment input. Any sediment placed in the central area is transported largely to the east to augment the aggrading spit and spit over to the seaward. Sediment management is a major challenge to the several agencies with jurisdiction over Plumb Beach that having different objectives, have to ameliorate the erosion at the central portion and reduce the sedimentation impacts on the marsh habitat.

Acknowledgments


References