

## APPLIED COASTAL

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**Project:** Two-Dimensional Hydrodynamic Modeling of Barnstable Harbor and Great Salt Marsh System, Barnstable, Massachusetts

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Applied Coastal engineers evaluated the hydrodynamic characteristics of Barnstable Harbor and Great Salt Marsh system, located along the northern shore of Cape Cod in Barnstable, Massachusetts, for purposes of calculating system flushing rates for selected estuarine subembayments and marsh creek systems. The purpose of the study was to develop flushing characteristics to guide Town planning efforts within the system's watershed regions.

As such, Applied Coastal developed a calibrated, two-dimensional numerical model of the estuary. This model relied upon data collected during an earlier study of the system in 1991-1993. This previous study measured system geometry (marsh elevations, bathymetry) as well as tidal elevation variations at several strategic locations. These data were used to generate a computer model that represented key features of the estuary.

The challenge in this program was to simulate the correct wetting/drying physics of the salt marsh plain, as the tidal inundation and draining of marsh regions can affect significantly the tidal signature within the estuary. The model was forced with water level measurements offshore, and calibrated against simultaneous water level measurements inside the estuary and marsh creeks. The model was verified against subsequent field observations to assure the essential hydrodynamics were being simulated correctly. Model results were used to calculate tidal prism (water volume transported into the system during a single flood tide) and system volume at various stages of the tide. Results showed the system hydrodynamics were dominated by tidal exchange with Cape Cod Bay (see figure), and that residence time for the Harbor was less than a day. Marsh creeks also benefited from the vigorous tidal exchange within the estuary, with residence times in the upper creek regions of order days.

