

### **III. DELINEATION OF WATERSHEDS**

#### **III.1 BACKGROUND**

Nantucket Island is located near the southern edge of late Wisconsinan glaciation (Oldale and Barlow, 1986). As such, the geology of the island is largely composed of outwash plain and moraine with reworking of these deposits by the ocean that has occurred since the retreat of the glaciers. The moraine, which is located relatively close to Nantucket Harbor, consists of unsorted sand, clay, silt, and gravel, while the outwash, which tends to be located toward the southern half of the main portion of the island is composed of stratified sands and gravel deposited by glacial melt water. The groundwater system of Nantucket Island is generally characterized by a shallow, unconfined aquifer and a separate deep, confined aquifer, although some recent deep well drillings have suggested that there are additional confining units of undetermined extent that are interlaced in the unconfined layer (Lurbano, 2001). These characterizations of the geology, including the installation of numerous long-term monitoring wells, by the US Geological Survey over the last few decades have provided the basis for subsequent activities, including the delineation of estuary watersheds. The Massachusetts Estuaries Project team includes technical staff from the United States Geological Survey (USGS).

During the development of the Nantucket Water Resources Management Plan, an island-wide groundwater mapping project, using many of the USGS wells, was completed to characterize the water table configuration (Horsley, Witten and Hegeman Inc., 1990). Estuary watershed delineations completed in areas with relatively transmissive sand and gravel deposits, like most of Cape Cod and the Islands, have shown that watershed boundaries are usually better defined by elevation of the groundwater and its direction of flow, rather than by land surface topography (Cambareri and Eichner 1998, Millham and Howes 1994a,b). This approach was used by Horsley, Witten and Hegeman, Inc. (HWH) to complete a watershed delineation for Sesachacha Pond (Figure III-1); this watershed delineation has been largely confirmed by subsequent water table characterizations (e.g., Lurbano, 2001, Gardner and Vogel, 2005).

#### **III.2 SESACHACHA POND CONTRIBUTORY AREAS**

MEP staff also compared the HWH Pond watershed to a 2004 aerial base map to see if any shoreline changes would require watershed alterations. This comparison found that this watershed delineation is still appropriate and, therefore, it is adopted as the MEP watershed and is used in the watershed analysis. There are no subwatersheds.

Based on the watershed areas and a recharge rate of 27.25 inches per year, a groundwater discharge volume was determined for Sesachacha Pond; this volume was used to assist in the salinity calibration of the tidal hydrodynamic models. The recharge rate was developed based on calibration of the Cape Cod groundwater models prepared by the USGS and used to delineate estuary watersheds for the MEP (Walter and Whealan, 2005). This recharge rate is also consistent with the upper portion of a range of calculated recharge on Nantucket based on tritium measurements (Knott and Olimpio, 1986). The overall estimated groundwater flow into Sesachacha Pond from the MEP watershed is 7,961 m<sup>3</sup>/d.

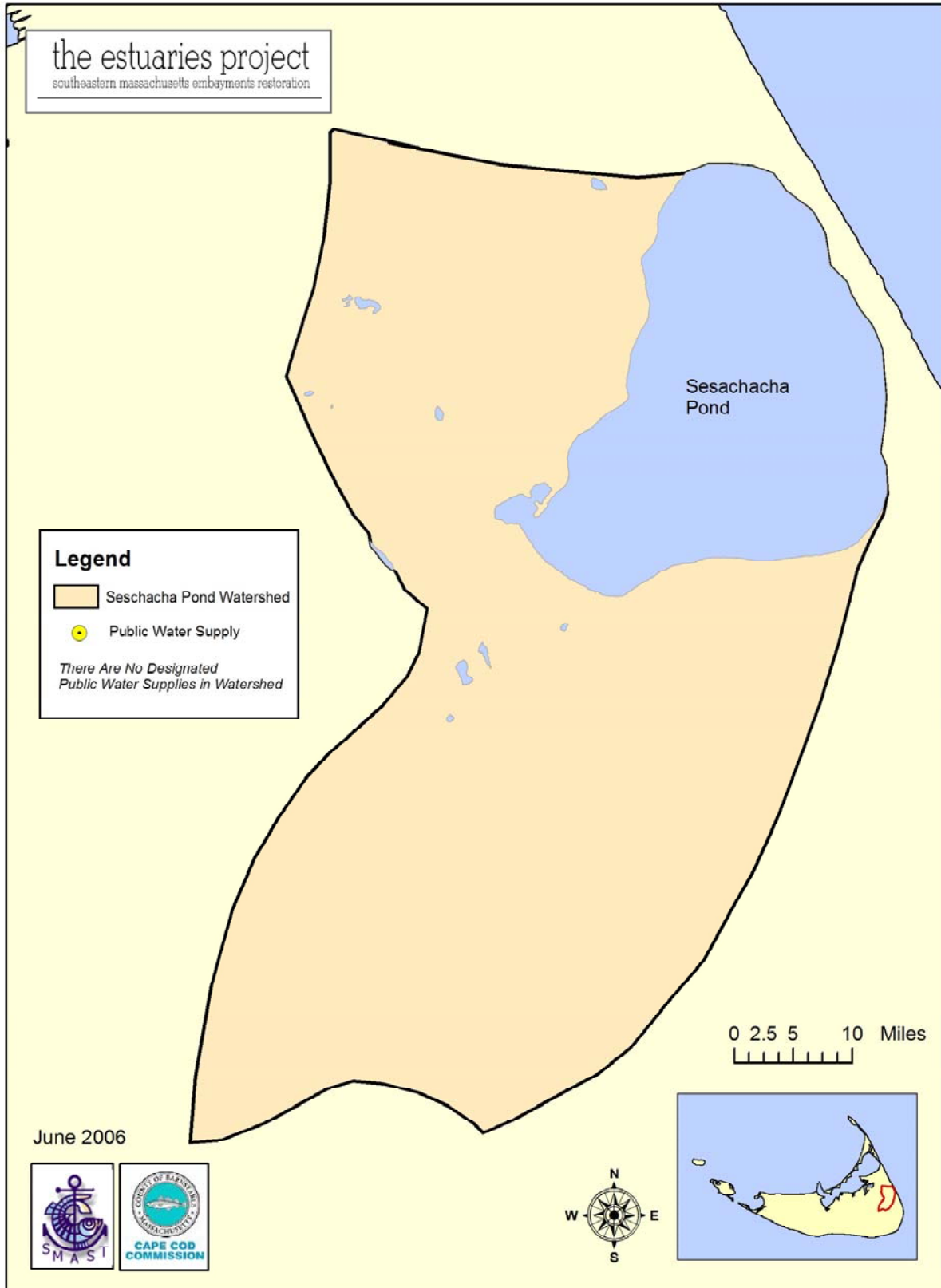


Figure III-1. Watershed delineations for the Sesachacha estuary system..

Review of watershed delineations for Sesachacha Pond allows new hydrologic data to be evaluated and the watershed delineation to be reassessed. The evaluation of older data and incorporation of new data during the development of the MEP watershed model is important as it decreases the level of uncertainty in the final calibrated and validated linked watershed-embayment model used for the evaluation of nitrogen management alternatives. Errors in watershed delineations do not necessarily result in proportional errors in nitrogen loading as errors in loading depend upon the land-uses that are included/excluded within the contributing areas. Small errors in watershed area can result in large errors in loading if a large source is counted in or out. Conversely, large errors in watershed area that involve only natural woodlands have little effect on nitrogen inputs to the downgradient estuary. The MEP watershed delineation was used to develop the watershed nitrogen loads to each of the aquatic systems and ultimately to the estuarine waters of the Sesachacha Pond system (Section V.1).