EXECUTIVE SUMMARY

Two surveys to evaluate the condition of the oldest capped dredged material disposal mound in New England were conducted in September 2007 and August 2009 as part of the U.S. Army Corps of Engineers (USACE) New England District Disposal Area Monitoring System (DAMOS). The mound, located at the historical Brenton Reef Disposal Site (BRDS), was constructed from 1967 to 1971 as part of the Providence River Navigation Improvement Project (PRNIP) that deepened the navigation channel from 10.7 to 12.2 m (35.0 to 40.0 feet). The BRDS was the location for the first known use of sediment capping in New England; because the dredging began in the upper Providence River, Rhode Island, and proceeded down the channel, the finest sediments with the greatest concentration of contaminants were disposed first and sequentially covered with coarser and less contaminated sediments from farther down the navigation channel and from projects in Point Judith, RI and Brayton Point Channel, MA (Pratt et al. 1973). The project also provided the impetus to begin scientific monitoring of dredged material disposal activities in the northeastern United States.

Because of the legacy of this capped mound, and the location of the mound on nearshore shelf sediments exposed to open ocean conditions, the long-term status of the sediments deposited there has interest for marine environmental management programs worldwide. The objectives of the 2007 and 2009 surveys were to characterize physical, chemical, and biological conditions at BRDS sufficiently to determine the stability of the disposal mound and whether contaminated sediments were isolated from the environment by the site's intentional, but not formally engineered, cap. The monitoring investigation also sought to gather and analyze data from this 40-year-old disposal site that could potentially provide insights beneficial to current and future dredged material placement practices.

A conceptual model was developed to provide a framework for interpretation of data collected during recent surveys. This model was based on the results of earlier investigations, the history of dredged material disposal at and around Brenton Reef, as well as the long history of contaminant input into Narragansett Bay, Rhode Island and a general understanding of the processes associated with open-water placement of dredged material. The mound was expected to contain a complex sedimentary structure with a trend of finer, more organic-rich and contaminated inner harbor material at the bottom of the mound and coarser, low-organic and low-contaminant-burden outer harbor material on the top of the mound. Because the mound was not created in a rigorously engineered manner, interlayering of the fine and coarse layers within the mound was expected rather than a discrete boundary between the harbor material and a cap layer. However, given the historical volume of material placed, it was expected that a layer of less contaminated, coarser sediments covered the bathymetrically defined mound. The surface of the mound and margin was expected to have evidence of deposition and reworking of both dredged

material and ambient sediments. The BRDS monitoring activities reported here were designed to gather, analyze, and interpret data and compare findings to those expected based on the conceptual site model.

In 2007, high resolution swath (multibeam) bathymetric and acoustic backscatter (side-scan sonar) data were collected over a study area that included the historical mound to determine the location of the mound, the size and shape of the mound, and the surface texture of the sediments. Sediment profile imaging (SPI) and plan-view underwater camera (PUC) images were collected across the mound surface and at three reference areas to assess fine-scale sediment texture and biological conditions for comparison with previous surveys.

In 2009, sediment cores were collected to assess the sediment layers within the interior of the disposal mound. Cores were collected from four locations on the main portion of the mound and from three locations within the margin of the mound, where the dredged material was expected to be thinner. Cores also were collected from two off-mound stations farther afield to provide additional information on the surrounding ambient sediments.

The historical BRDS mound has remained remarkably stable over 40 years: the size, location, and shape are virtually the same as surveyed in 1970 immediately after disposal of the majority of material. In 1970, the surface texture of the mound was reported as unconsolidated silts overlying coarser sands; in 1987, the surface texture was a mosaic of well-sorted sands, poorly sorted gravels, and shells. These descriptions were based on isolated samples collected over the mound surface. The combination of mosaicked, processed backscatter data, high resolution bathymetric data, and SPI and PUC images collected in 2007 provided a hitherto unseen characterization of the dynamic complex surface of this mound. This complex surface is consistent with previous survey results, as well as the conceptual model, and verifies that the large-scale morphology of the mound remains unchanged. It is clear that despite evidence of surface sediment modification across the surface of the mound, the mass of material placed on the seafloor from 1967 to 1971 has remained in place. The silts reported on the surface in 1970 likely eroded, and a variable lag deposit composed of well-sorted sand, gravels, shells, and poorly sorted mixtures with patches of compacted silt covers the surface of the mound.

The results of chemical sampling of cores collected from the Brenton Reef Disposal Site showed that there remains a thick cap on the main portion of the mound and no evidence of contaminants in surface sediments, suggesting that the sub-surface samples containing contaminants are well isolated from the benthic environment. The shallowest elevated concentrations of metal and PAH contaminants were found at a depth of 28-38

cm (11-15 in) in a core collected on the margin of the mound. The surficial sample from this core consisted of nearly equal fractions of sand and fines and showed no evidence of contaminant migration from the lower interval. The presence of the 20+ cm (8+ in) layer above the contaminated layer is sufficient to limit biological mixing or exposure to contaminants (Rhoads and Carey 1997), and the off-peak/slope location of this core is unlikely to experience physical disturbance from periodic storms.

Based on the evidence that the disposal site is subjected to periodic sediment reworking, but remains virtually the same size and shape as surveyed in 1978, it is recommended that the general oceanographic conditions of the area be monitored for storms that might exceed the storms documented here. If a storm with peak wave height of greater than 7.0 m (23 ft) is recorded at WIS Buoy #63078 with a direction within the BRDS open-water storm exposure range (110 to 190° T), a reconnaissance survey with multibeam bathymetry and acoustic backscatter collection to assess the condition of the surface of the mound is recommended. If these results indicate that the mound lost more than 1 m (3 ft) in height and changed shape (more than 20% of the 3-dimensional volume altered), a Sediment Profile Imaging (SPI) survey to confirm results is recommended. If the SPI survey records extensive exposure of fine grained material with limited biological recovery (lack of Stage 3 evidence persists in fine grained sediments more than 1 year after disturbance), sampling and testing of bulk sediment in the areas where SPI results indicate impaired recovery of fine grained sediments are recommended.