EXECUTIVE SUMMARY

An investigation of the 11 confined aquatic disposal (CAD) cells in Boston Harbor was performed in November 2009 as part of the U.S. Army Corps of Engineers New England District Disposal Area Monitoring System (DAMOS) Program. Nine of the CAD cells were constructed beneath the navigation channel in the Mystic and Chelsea Rivers and the Inner Confluence as part of the Boston Harbor Navigation Improvement Project (BHNIP) from 1997–2000. Two additional cells were constructed in the Mystic River and the Main Ship Channel of the Inner Confluence as part of a separate dredging project in 2008. The CAD cells were created to contain dredged material deemed unsuitable for unconfined open water disposal (UDM). With the exception of the Chelsea River cell, the original BHNIP cells were capped with a layer of sand to further isolate the UDM from the environment. The two newest cells were capped in early 2010, following the 2009 survey reported here.

As the BHNIP marked the first major use of CAD cells in the United States, numerous studies were conducted during and following the project to assess potential impacts to water quality, to assess the effectiveness of capping, and to assess the long-term stability and benthic recovery of the CAD cells. A 2004 investigation confirmed the stable topography and benthic recolonization (Stage 1 pioneering organisms) of the cells, consistent with previous studies and the surrounding harbor system (ENSR 2007). The 2004 survey also documented the deposition of a significant amount of fine-grained material on top of the cells' caps; however, the survey method (sediment-profile imaging) provided a limited number of point measurements over the cells and was not able to resolve the full thickness of deposition over the cap layer.

The 2009 investigation was designed to assess the post-construction condition and performance of all 11 CAD cells for comparison with past and future surveys and to assess post-capping sedimentation rates and the depth of surficial mixing over select cells. This was achieved through a multibeam bathymetric survey of all 11 cells and the surrounding channel, a towed sub-bottom survey of three cells in the Mystic River (M 8-11, M19, and the Supercell), and the collection of sediment cores from 15 locations across the same three CAD cells and reference areas in the Mystic River.

The bathymetric data collected as part of the 2009 survey confirmed the stable topography of the nine cells created during the BHNIP and documented the dimensions of the two newer cells created in 2008. Each of the BHNIP cells had well-defined side walls and surface features consistent with previous surveys. Comparison of the 2009 and 2004 bathymetric data did not identify any features indicative of erosional processes. The depth comparison did identify limited areas of deposition over some cells, but ongoing, long-term consolidation of material within

the cells likely masked the majority of deposition expected to occur at the surface of the cells.

The 2009 sediment coring and sub-bottom profiling efforts were designed to better characterize the thickness of accumulated fine material over the underlying sand caps in cells M8-11, M19, and the Supercell. These cells were selected for study because of the uniform sand layer that was identified across their surfaces at the end of BHNIP, making deposition tracking possible. The data from the low disturbance cores confirmed that the sub-bottom profiling was able to accurately resolve the fine-grained deposition over coarse-grained cap layering. Analysis of sub-bottom data indicated that cell M8-11 had accumulated an average of 0.24 m and the Supercell had accumulated an average of 0.35 m of material in the 9–10 years since capping, translating to deposition rates of 2.7 and 3.5 cm/yr, respectively. This calculated deposition rate is well in excess of a reported long term deposition rate of 0.5 cm/yr for the Mystic River, but is considered realistic given that the cells act as sediment traps depressed below the harbor bottom. Deposition of 0.65 m of material over the same time frame into cell M19 was considered inflated due to the recent excavation and filling of the Mystic River CAD cell that closely bordered two sides of cell M19.

The biological mixing zone, estimated by measuring the oxidized layer at the surface of sediment cores, averaged less than 2.6 cm for both CAD cell stations and reference cores. The shallow biological mixing documented in 2009 supported earlier findings of harbor-wide conditions limiting benthic recolonization to a state of perpetual early succession throughout the harbor. Very fine layering was also apparent at the surface of both CAD cell and reference cores further supporting the persistence of shallow sediment mixing in Boston Harbor.

The results of the 2009 survey, performed some nine to 12 years following completion of the BHNIP, identified all of the CAD cells as continued stable features on the harbor bottom. This stability coupled with observed limited mixing of sediment at the surface of the cells supports the effectiveness of sequestering material within the CAD cells. Further, the accelerated deposition rate over cells depressed below the surrounding harbor exceeded the observed biological mixing depth, indicating the ability of natural deposition to sequester cell material in a relatively short period of time. As the BHNIP identified that the cells required a consolidation period approaching a year in length before the sand cap could be effectively applied (during which time deposition was already occurring), the overall need for a cap, particularly one requiring non-ambient material transported over significant distances, is called into question. Rather, the specific requirements for placement of a cap over a CAD cell containing UDM should be evaluated on a case-